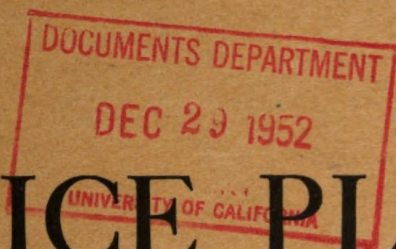


# TM 5-9194

WAR DEPARTMENT TECHNICAL MANUAL

165 Dept. of the Army



## ICE PLANT

3.6-TON  
YORK

1/4 Bind  
0113  
.2  
TM 5: 9194  
1944

MAINTENANCE INSTRUCTIONS  
AND PARTS CATALOG

WAR DEPARTMENT • 15 APRIL 1944



**MAINTENANCE MANUAL**  
**and**  
**PARTS CATALOG**  
**for**  
**ICE PLANT, 3.6-TON, YORK**

**SERIAL NOS. 169906-11 TO 169914-23 INCL.**

**SERIAL NOS. 187685 TO 187774 INCL.**

# **WAR DEPARTMENT**

**Washington 25, D. C., (15APR1944)**

**TM5-9194 (Ice Plant, 3.6-Ton, York), is published  
for the information and guidance of all con-  
cerned.**

**A.G. 300.7 (15APR1944)**

**BY ORDER OF THE SECRETARY OF WAR**

**G. C. MARSHALL,  
Chief of Staff.**

**Official:**

**J. A. ULIO,  
Major General,  
The Adjutant General.**

**Distribution:**

**X (For Explanation of Symbol see FM 21-6)**

# TABLE OF CONTENTS

## PART I. DESCRIPTION AND OPERATION

Description of Plant .....	6-7
Condensing Unit .....	7-16
Description .....	7-12
Valve Nomenclature .....	12-13
Operation .....	13-16
Freezing Tank Assembly .....	17-22
Freezing Tank and Coils .....	17-20
Vertical Agitator .....	20
Can Dump .....	20-21
Ice Can Hoist and Filler .....	22
Ammonia Float Regulator .....	23
Water Regulating Valve .....	24-25
Diaphragm Relief Valves .....	25-26
Water Piping Connections .....	26-27
Low Pressure Ammonia Cut-out .....	27-28
High Pressure Ammonia Cut-out .....	28
Cartridge Type Relief Valve .....	28-29
Dual Relief Valve Assembly .....	29-30
Starting Operation, Electrical .....	30-34
Compressor Motor .....	34
Compressor Motor Starter .....	35
Agitator Motor .....	36

## PART II. MAINTENANCE AND INSTALLATION

Cleaning Pipe .....	39
Making Joints .....	39
Installing Valves .....	40
Compressor Piping .....	40
Evaporator Piping .....	40
Air Pressure Test .....	40-41
Evacuating System .....	41
Handling Ammonia .....	41
First Aid Treatment .....	41-42
Charging Ammonia .....	42-43
Checking Ammonia Charge .....	43-44
Testing for Leaks .....	44
Use of Re-Agents .....	44-49
Ammonia Tables .....	45-48
Use of Soap Suds .....	49
Purging Condensers .....	49
Freezing Tank Installation .....	49-50
Assembling Tank .....	50-51
Assembling Coils .....	51
Placing Cans and Mixing Brine .....	51-52
Brine Characteristics .....	52
Brine Treatment .....	52
Sodium Chloride Table .....	53
Condensing Unit .....	52
Installation .....	52-54
Maintenance .....	54-57
Ammonia Float Regulator .....	57-58
Condenser Maintenance .....	58-60

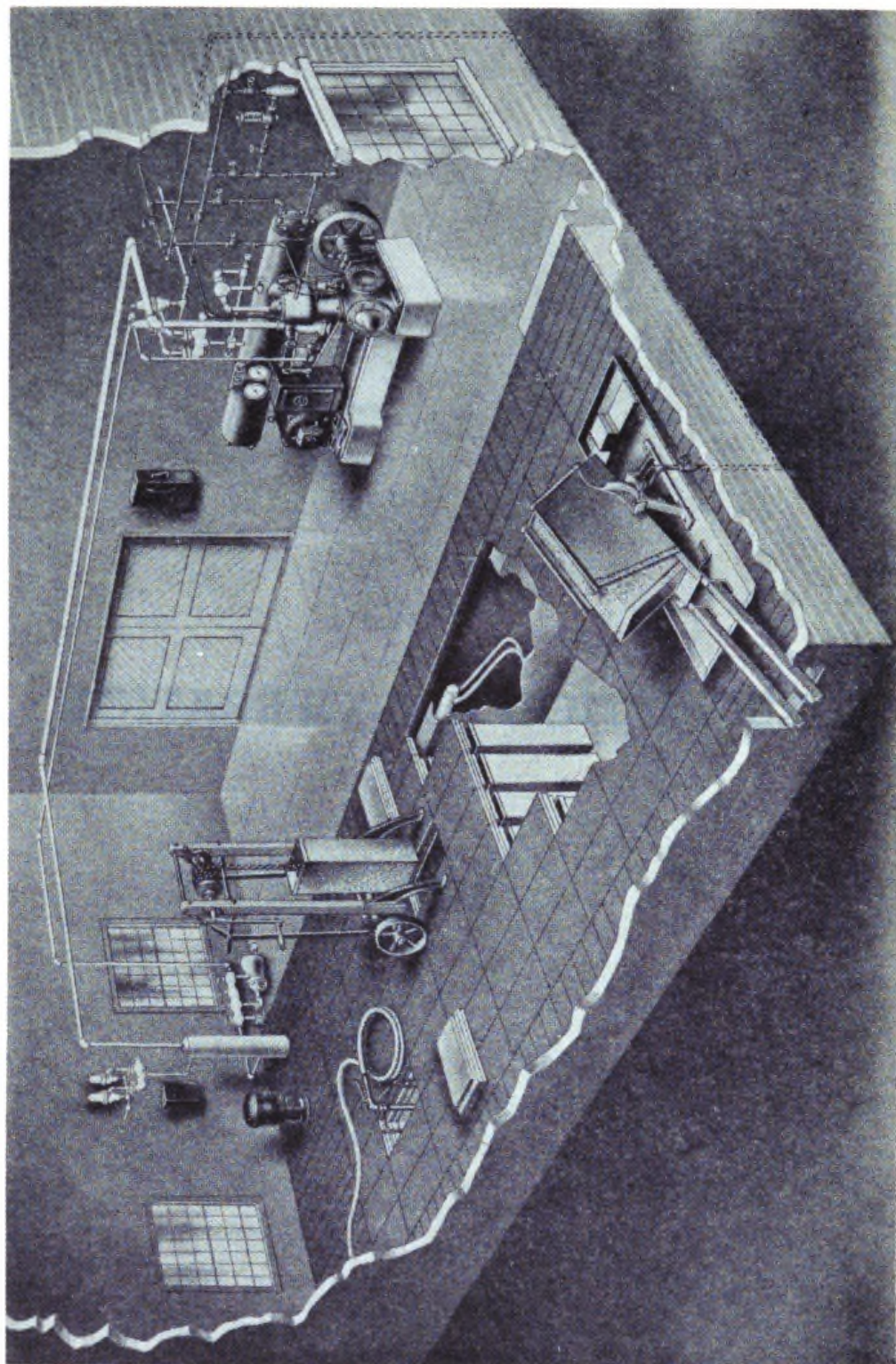
## PART III. PART SECTION

Section through Compressor .....	64
Compressor Parts .....	65-66
Listing of Spare Parts .....	67-74
First Echelon Spare Parts and Tools .....	74
Illustration of Compressor Parts .....	75



**PART I**

**DESCRIPTION and OPERATION**



## DESCRIPTION OF 3.6 TON ICE PLANT

The ice plant described in these instructions is boxed for export and the various parts arranged for assembly at the building site.

Before attempting to assemble the equipment the construction engineer must refer to the set of drawings and material lists packed with each unit. The steel for the ice tank is shipped knocked down and must be welded in the field, similarly the ammonia piping, water piping, and electric wiring must be cut to fit and assembled during the erection of the plant.

The major parts of each system consists of a York Self Contained Condensing Unit (containing the compressor, condenser, compressor motor, and compressor starter), the ice making tank (containing the steel tank, oak framework, agitator, agitator motor and starter, evaporator coil and ice cans) and the ice can dump, ice can hoist and can filler. Some of the plants are equipped with a forced draft cooling tower and water pump furnished by other contractors. The electrical equipment is arranged so that with a few changes either 208 volt, 3 phase, 60 cycles, or 400 volt, 3 phase, 50 cycle current may be used.

The ice making equipment will produce 3.6 tons of opaque ice in 24 hours when the makeup water enters the cans at a maximum temperature of 80° F. The initial temperature of the condensing water will affect the capacity of the plant, and in the case of the systems using a cooling tower the atmospheric temperature and humidity will affect the temperature of the condensing water. All plants must be operated by hand.

Ammonia is used as the refrigerant and, after the plant has been initially placed in operation, it is stored in the low pressure suction trap and evaporator coils. With the compressor in operation, low pressure gas from the evaporator is drawn off by the compressor which compresses and heats the vapor, discharging the hot gas into the water cooled condenser where the hot gas is cooled to a liquid by contact with the colder water tubes in the shell.

The liquid ammonia from the condenser is forced by pressure through the expansion valve (Ammonia Float Regulator), where its pressure is reduced to that existing in the evaporator coil.

The boiling point of ammonia at atmospheric pressure (14.7 lbs.) or zero pounds gauge is — 28° F., at different pressures the boiling point changes and the plants are designed to operate at a suction pressure, or refrigerant boiling point, high enough to prevent penalizing the compressor operation, but low enough so that the proper brine temperature can be carried in the freezing tank.

A more detailed description and method of operation follows.

### CONDENSING UNIT (Fig. 2)

#### (1) DESCRIPTION

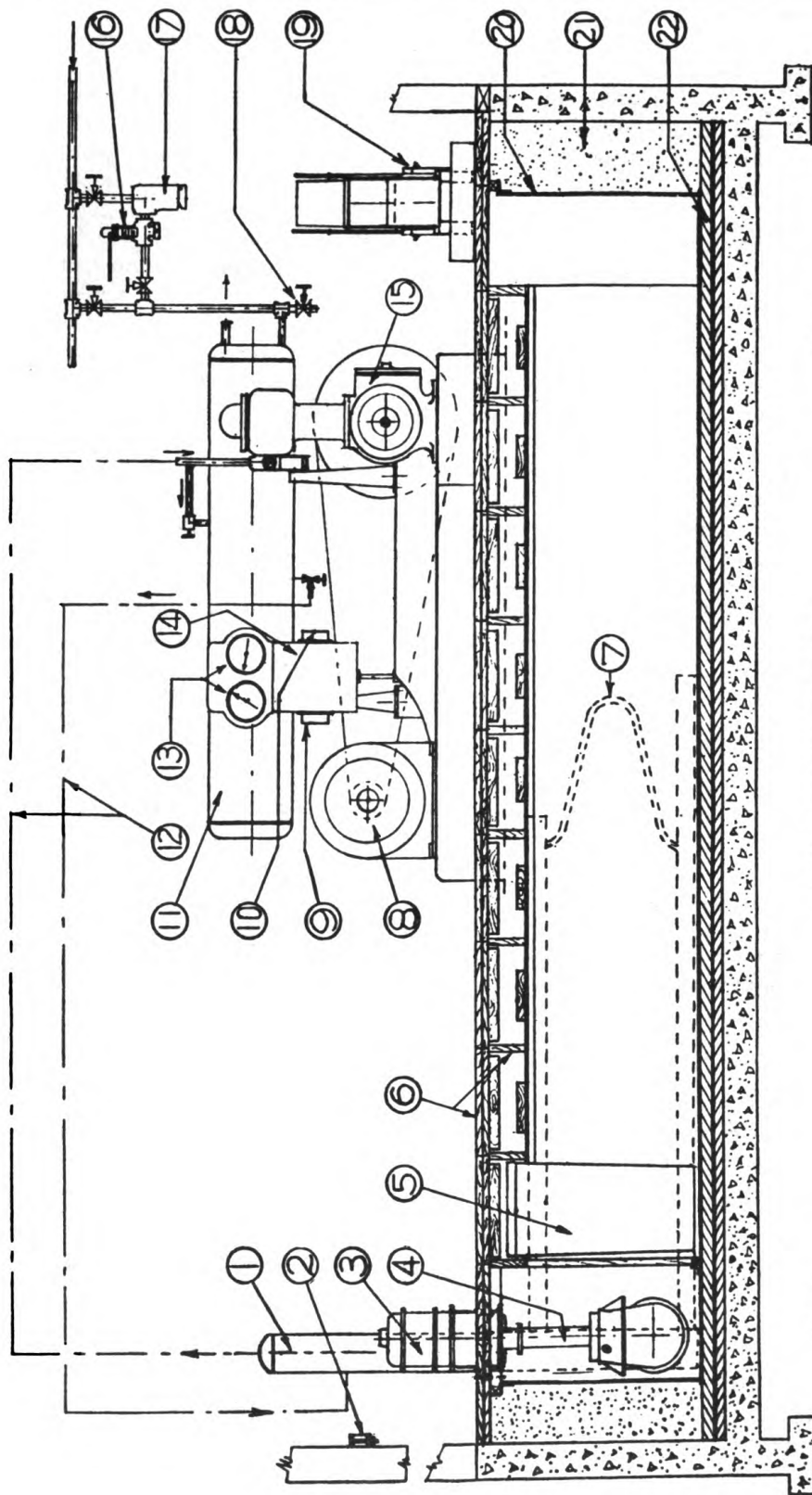
The York condensing unit furnished for these installations is an assembly of several major parts mounted on a cast iron base, and arranged to operate as a unit. The following major items of equipment are included:

##### A. Compressor

A York single acting vertical two cylinder ammonia compressor with 5" bore and 5" stroke, driven by means of multiple V-belts from a 20 H.P. motor. The operating speed is 400 R.P.M.

All parts of the machine are easily accessible and arranged so that the wearing parts may be readily replaced if necessary.

The lubrication system is forced feed, operated by means of an oil pump located in the compressor crankcase and mounted on the crankshaft.



## PARTS REFERENCE, FIG. 1

## Parts

- 1 Suction Trap, see Fig. 7
- 2 Agitator Motor—1½ H.P. Howell, see Fig. 26
- 3 Vertical Agitator, see Fig. 8
- 4 Ice Can, 100 lbs. size (nominal)
- 5 Oak Framework and Covers, see Fig. 6
- 6 Freezing Tank Coils, see Fig. 7
- 8 Compressor Motor—20 H.P. Westinghouse, see Fig. 24

## Parts

- 9 Mercoid High Pressure Cut-out, see Fig. 18
- 10 Mercoid Low Pressure Cut-out, see Fig. 17
- 11 Ammonia Condenser, see Fig. 1
- 12 Ammonia Piping, see Fig. 3
- 13 Ammonia Pressure Gauge, see Fig. 4
- 14 Compressor Motor Starter—20 H.P. Westinghouse, see Fig. 25
- 15 Ammonia Compressor, see Fig. 31

## Parts

- 16 Water Regulating Valve, see Fig. 13
- 17 Water Strainer, Drawing 163104
- 18 Condenser Drain
- 19 Rocking Sprinkler Can Dump, see Fig. 9
- 20 Steel Freezing Tank, per Drawing S435204 Y
- 21 Granulated Cork Insulation
- 22 Corkboard Insulation
- 23 Ice Can Hoist (not shown), see Fig. 10
- 24 Ice Can Filler (not shown), see Fig. 11

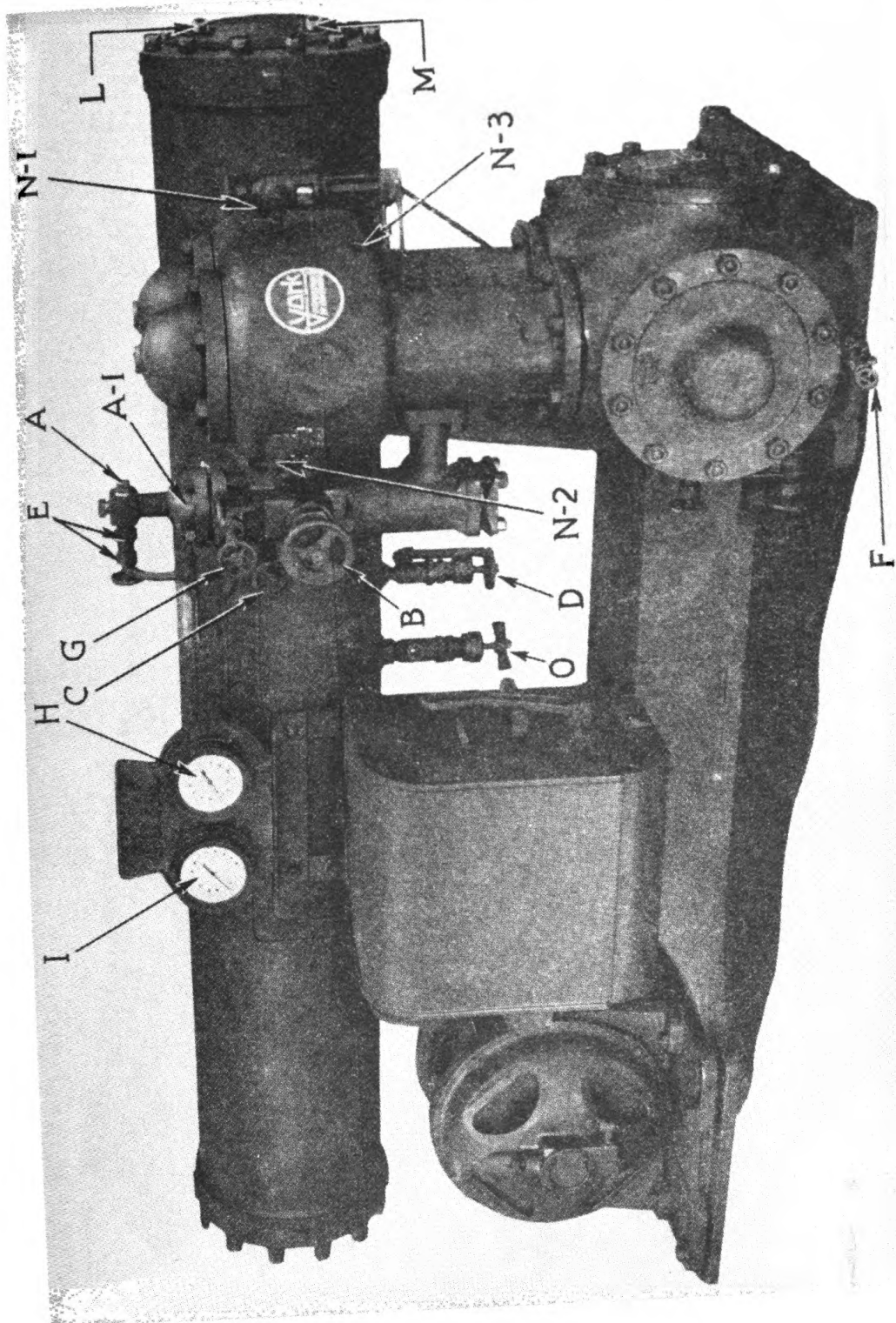
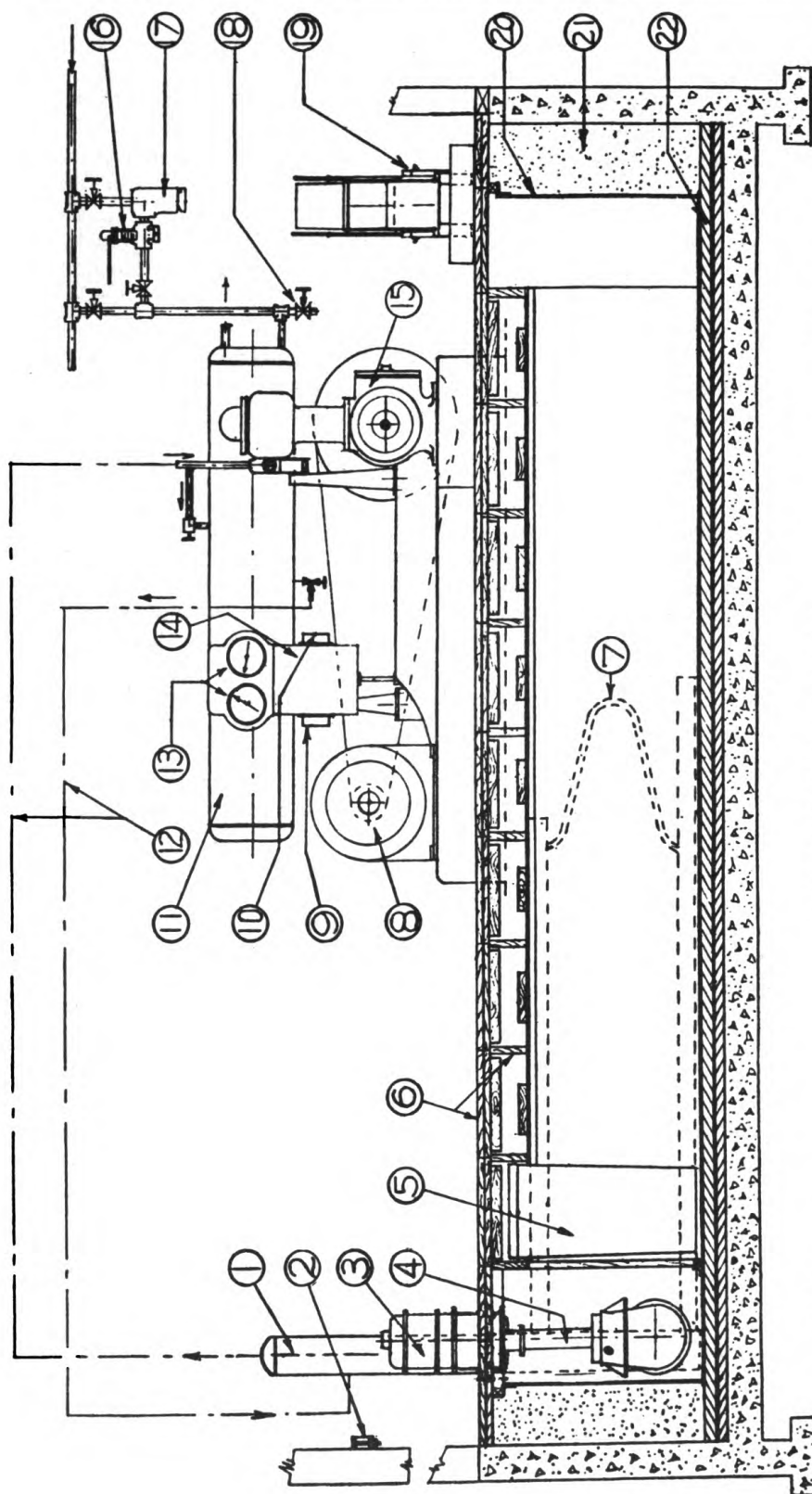


FIG. 2

225708 O - 52 - 2



- PARTS REFERENCE, FIG. 1**
- |  |  |
|--|--|
| <p><b>Parts</b></p> <p>1 Suction Trap, see Fig. 7</p> <p>2 Agitator Motor—1½ H.P. Howell, see Fig. 26</p> <p>3 8" Vertical Agitator, see Fig. 8</p> <p>4 Ice Can, 100 lbs. size (nominal)</p> <p>5 Oak Framework and Covers, see Fig. 6</p> <p>6 Freezing Tank Coils, see Fig. 7</p> <p>8 Compressor Motor—20 H.P. Westinghouse, see Fig. 24</p> | <p><b>Parts</b></p> <p>9 Mercoid High Pressure Cut-out, see Fig. 18</p> <p>10 Mercoid Low Pressure Cut-out, see Fig. 17</p> <p>11 Ammonia Condenser, see Fig. 1</p> <p>12 Ammonia Piping, see Fig. 3</p> <p>13 Ammonia Pressure Gauge, see Fig. 4</p> <p>14 Compressor Motor Starter—20 H.P. Westinghouse, see Fig. 25</p> <p>15 Ammonia Compressor, see Fig. 31</p> |
|--|--|

- Parts**
- 16 Water Regulating Valve, see Fig. 13
- 17 Water Strainer, Drawing 163104
- 18 Condenser Drain
- 19 Rocking Sprinkler Can Dump, see Fig. 9
- 20 Steel Freezing Tank, per Drawing S435204 Y
- 21 Granulated Cork Insulation
- 22 Corkboard Insulation
- 23 Ice Can Hoist (not shown), see Fig. 10
- 24 Ice Can Filler (not shown), see Fig. 11

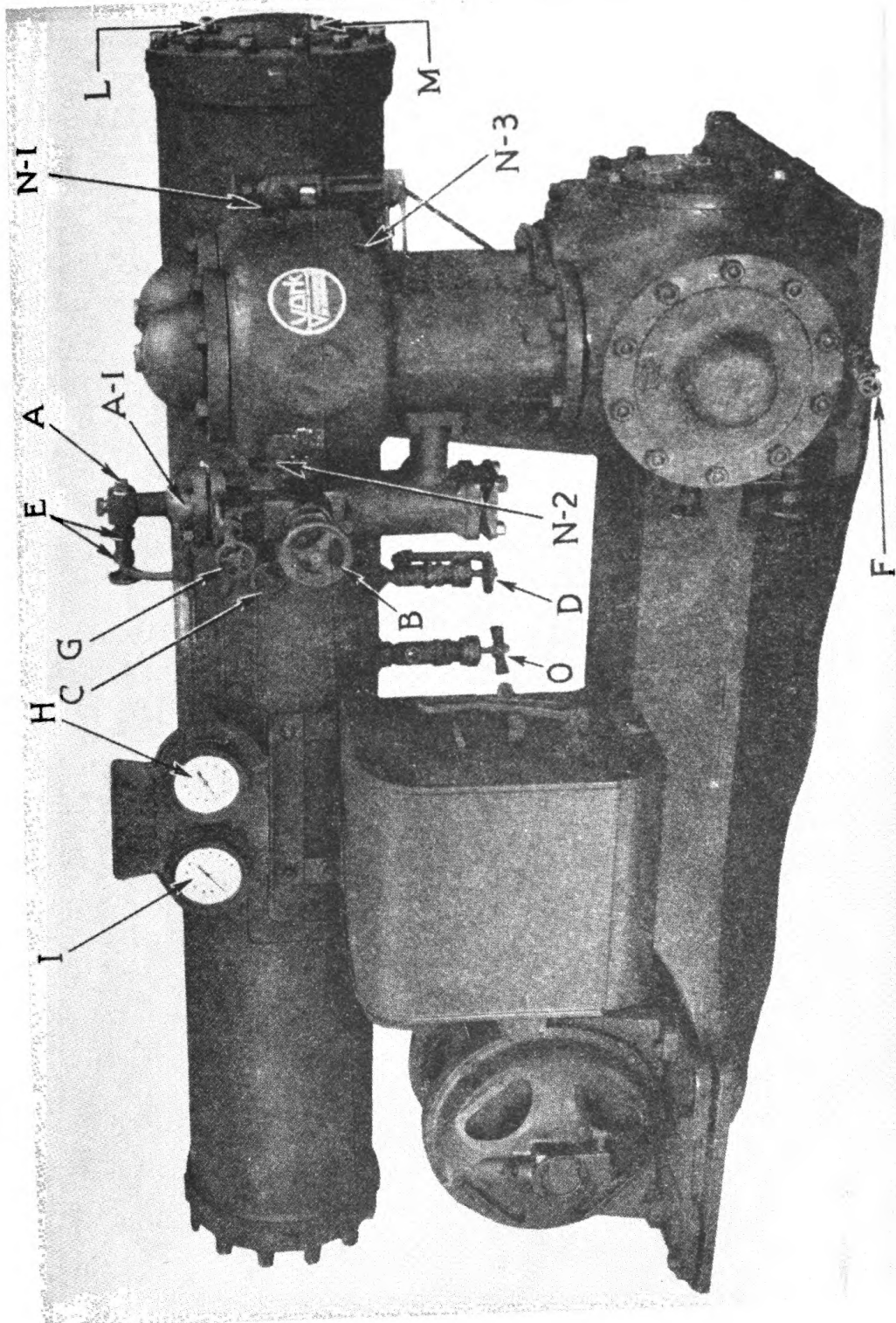


FIG. 2

225708 O - 52 - 2

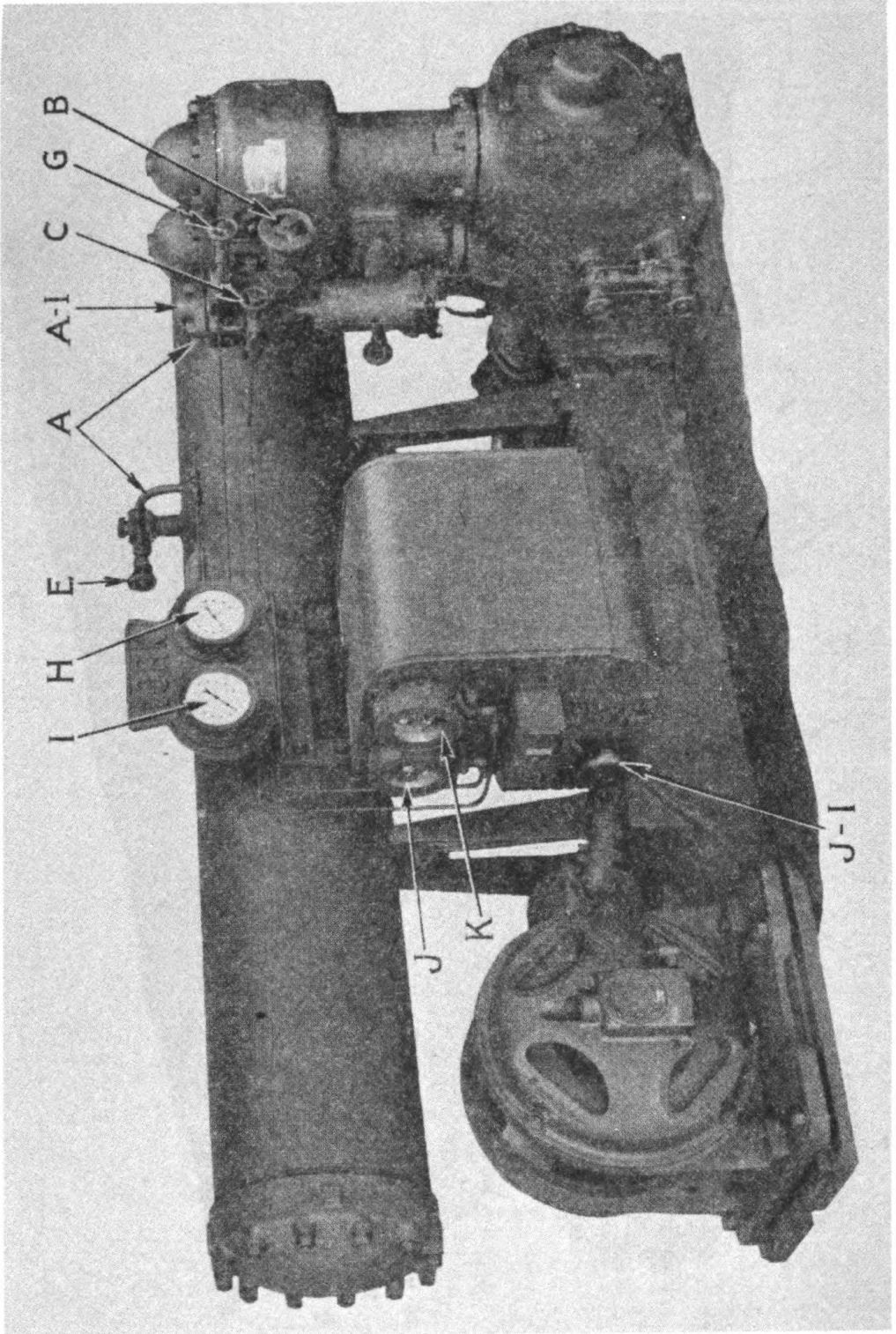
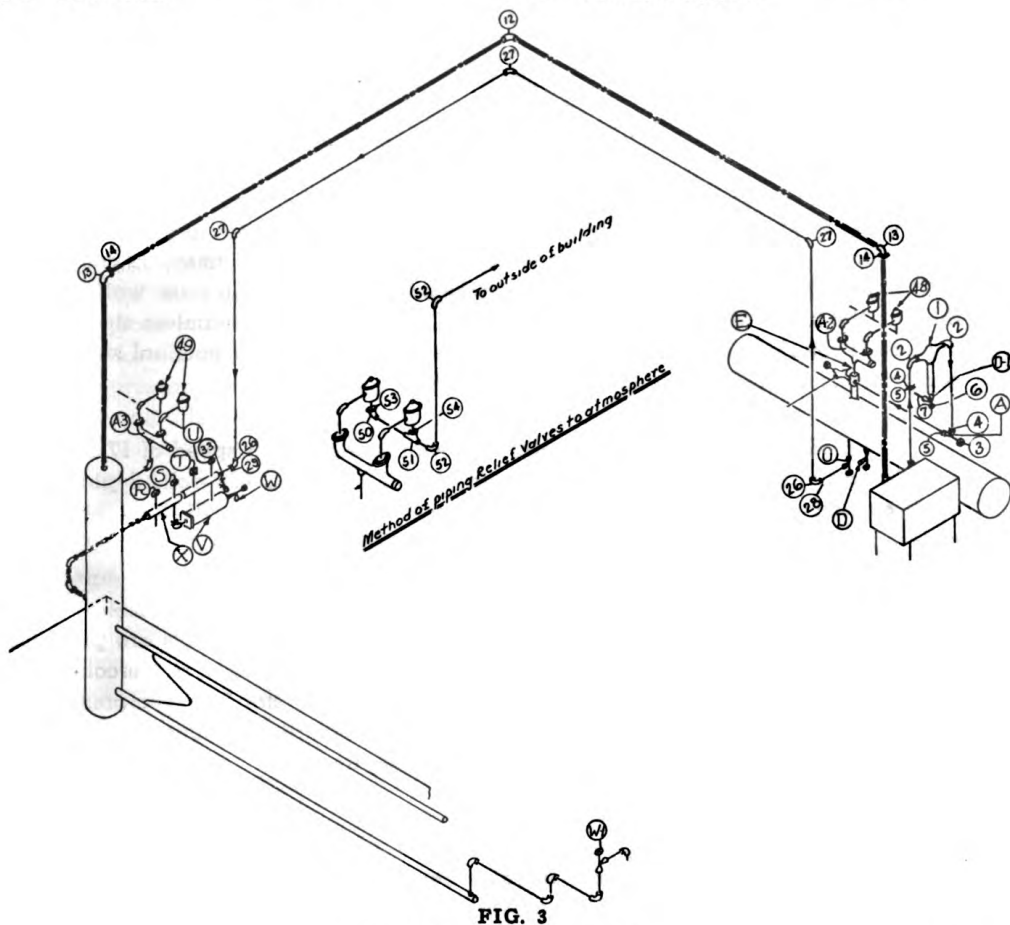


FIG. 2A

FIGS. 2, 3, 4

Parts	
A	Compressor Discharge and Valve
A-1	Compressor Relief Valve—Fig. 2
A-2	Dual Relief Valve Assembly—Fig. 3
A-3	Dual Relief Valve Assembly—Fig. 3
B	Compressor Suction Valve
C	Compressor Purge Valve
D	Condenser Oil Drain Valve
D-1	Oil Separator Drain Valve
E	Condenser Purge Valve
F	Compressor Oil Drain Valve
G	Low Pressure Control Valve
H	Low Pressure Gauge
I	High Pressure Gauge
J	High Pressure Cut-out—Fig. 4
J-1	Bell Alarm

Parts	
K	Low Pressure Cut-out—Fig. 4
L	Condenser Water Outlet
M	Condenser Water Inlet
N-1	Compressor Head Water Inlet
N-2	Compressor Head Water Outlet
N-3	Compressor Head Drain
O	Condenser Liquid Outlet Valve
R	Charging Valve
S	Float Regulator Outlet Valve
T	Hand Expansion Valve
U	Float Regulator Inlet Valve
V	Ammonia Float Regulator—Fig. 3
W	Float Regulator Oil Drain
W-1	Evaporator Coil Oil Drain—Fig. 3
X	Manifold By-pass



AMMONIA MAINS, FIG. 3

Parts	Quantity Per Unit
1 1" Oil Separator A-7279	1
2 1" Scrd. Street Ells, Crane 268E	2
3 1" Ov. Flanged Angle Valve, 1570F, B & G	1
4 1" Ov. Male Flgs., 1661-F B & G	2
5 1" Ov. Female Flgs., 1661-F	2
6 1/2" Steel Angle Valve	1
7 Nipple 1/2" E.H. x 6"	1
12 1 1/2" Scrd. Ell, 1842-F	1
13 1 1/2" Scrd. and Sq. Fig. Ell, B & G	1
3767F	2
14 1 1/2" Sq. Male Flgs.	2
26 1/2" Scrd. & Ov. Fig. Ells, B & G	2
8528F	2

Parts	Quantity Per Unit
27 1/2" Scrd. Ells, 8439F	3
28 1/2" Ov. Male Fig., 1657F B & G	1
29 1/2" Ov. Male Fig. Tapped 3/4", 1657F	1
33 3/4" E.H. x 6" Nipple	1
48 Relief Valve Assembly, 250 lb. Set, Drwg. 154000	1
49 Relief Valve Assembly, 150 lb. Set, 8528F	2
50 1/2" Scrd. & Ov. Fig. Ell, B & G	2
51 1/2" Scrd. & Ov. Fig. Tee, B & G	2
4838F	2
52 1/2" Scrd. Ells	2
53 1/2" Ov. Male Fig., B & G 1657F	2
54 1/2" Ov. Female Fig., B & G 1658F	2

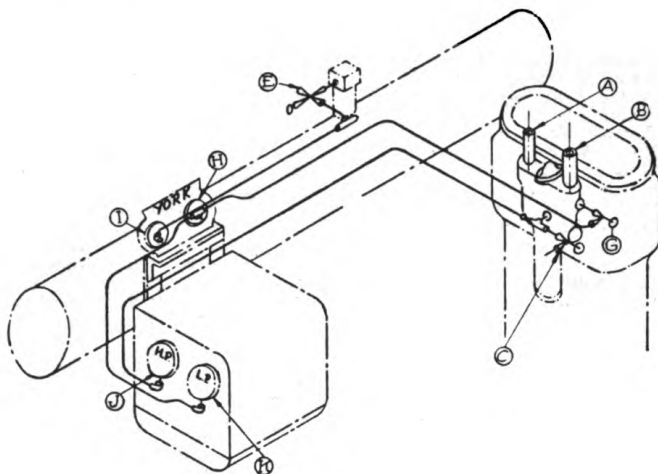


FIG. 4

### B. Condenser

The condenser is a York horizontal closed type shell and tube ammonia condenser with removable heads. The heads are arranged to form a multi-pass water travel through the tubes. The shell contains 46  $1\frac{1}{4}$ " O.D. No. 13 BWG seamless steel tubes, accessible for cleaning and replaceable in case of damage. The nominal size of the condenser is 14" x 7'-0".

### C. Motor

A Westinghouse 20 H.P. motor is furnished with an operating speed of 1750 R.P.M. for 208 volt, 3 phase, 60 cycle current, or 1450 R.P.M. with 400 volt, 3 phase, 50 cycle current.

### D. Controls

The compressor motor starter is a 20 H.P. manual reduced voltage starter arranged for current characteristics suitable for use with the compressor motor.

In addition to the reduced voltage starter, additional safety controls are provided and mounted on the side of the starter box. These controls are: a Mercoid High Pressure Ammonia Cut-out with bell alarm arranged to stop the compressor on excess condensing pressure, and a Mercoid Low Pressure Ammonia Cut-out that stops the compressor on low ammonia suction pressure.

## (2) VALVE NOMENCLATURE

The following main operating valves are shown on pages 9-12 and designated as:

- A. Discharge valve. The main shut-off valve between the compressor and condenser.
- B. Suction valve. The main valve located in the compressor manifold and between the ice tank coil and compressor.
- C. Compressor purge valve. Located in front of the suction manifold and in the high pressure side. Used only when evacuating air from the system before charging.
- D. Condenser oil drain. For draining excess oil that collects in the bottom of the condenser shell.
- E. Condenser purge valve. This valve is a tee valve with one side plugged. In normal operation it is the high pressure gauge valve. With the steel plug in the run removed, it is used for purging air from the condenser.
- F. Compressor oil drain. Used for draining oil from the crankcase, and for refilling.
- G. Low pressure gauge valve. Located on the side of the compressor manifold, and used as a shut-off valve only.

- O. Main liquid line stop valve. Located on the bottom of the condenser. Normally it is to remain open, but is closed when charging the plant.
- R. Ammonia charging valve. This valve is part of the liquid line manifold and is always closed except when the plant is being charged with ammonia.
- S. Liquid outlet from float valve. This valve to remain open in normal operation.
- T. Hand expansion valve. Located in the liquid line manifold. Normally closed, but may be used when charging the plant or for a short period of time if the float valve is out of operation for repair.
- U. Liquid inlet to float valve. This valve is to remain open in normal operation.
- V. High pressure float regulator. This valve automatically controls the flow of ammonia to the freezing tank coils. A more complete description follows.
- W. Float valve drain. Used only when taking the float valve down for repairs.

### (3) OPERATION

#### A. General

At the end of the first week of operation, permanent adjustments should be made to all automatic features. At this time the oil should be changed in the crankcase, the suction strainer (539) should be cleaned, and the condenser purged of any air remaining in the system.

#### B. Starting in Operation (Refer to Pages 9-12)

After the system has been installed and charged in accordance with instructions the plant may be placed in operation.

Before starting, be sure the water inlet and outlet valves to the condenser and compressor are opened, and that the water pump has been connected up for correct operation.

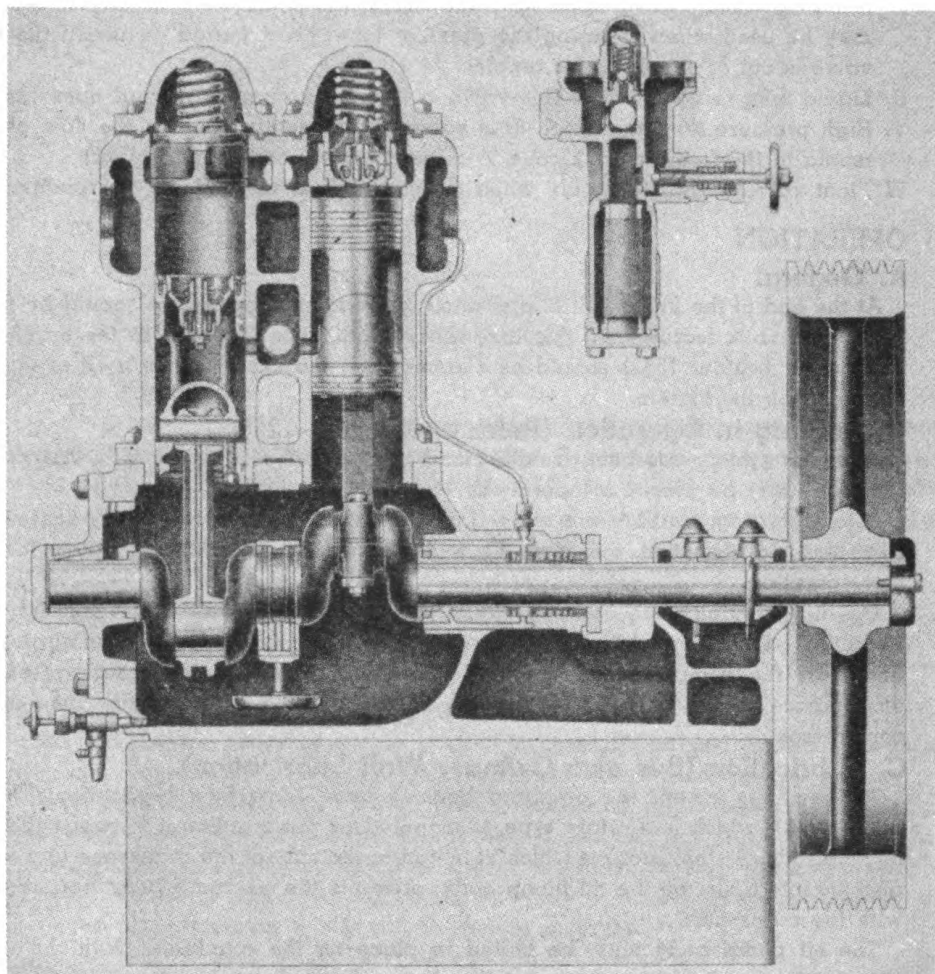
On the ammonia side open the following valves: "A," "B," "E" (slightly), "G" (slightly), "O," "S" and "U." Then throw the compressor starter to running-position and start the compressor. Since the agitator, mounted on the freezing tank, is on separate control it will be necessary to start it at about the same time as the compressor.

#### C. Lubrication (See also Cylinder Wall Lubrication)

All bearings except the outboard bearing have force feed lubrication. The oil pump (918), which is a rotary type, is mounted on the crankshaft between the connecting rods. A steel bracket which is bolted to the side of the crankcase and which also fits into a slot on the oil pump body, prevents the oil pump body from rotating with the crankshaft.

The oil pump body must be bolted in place on the crankshaft with the arrow pointing in the direction of crankshaft rotation. To reverse the direction of rotation, unbolt the cap from the pump body and turn both body and cap 180 degrees about a vertical axis. Keep the oil level in the crankcase at the proper height. After the first week of operation the oil in the crankcase should be removed, the oil pump strainer (923) cleaned and the crankcase cleaned and filled with new oil. To remove the oil, close suction valve (B) (Fig. 2) and run the compressor until a vacuum is produced in the crankcase. Test the vacuum by opening the oil charging valve "F" slightly. As soon as the crankcase has been pumped out, stop the compressor and drain the oil into a suitable container. It will be necessary to loosen the cover plate (528) and admit air to the crankcase before the oil will drain out. After the oil has been drained, remove the crankcase cover, thoroughly clean the interior with clean rags, and fill with new Ammonia Compressor Oil. CAUTION: Do not use waste, gasoline, or kerosene in cleaning the crankcase.

After the first month of operation the oil should again be removed, the oil pump strainer screen cleaned and the crankcase cleaned and filled with new oil.



**FIG. 4A**  
**SECTION THROUGH COMPRESSOR**

# LUBRICATION GUIDE

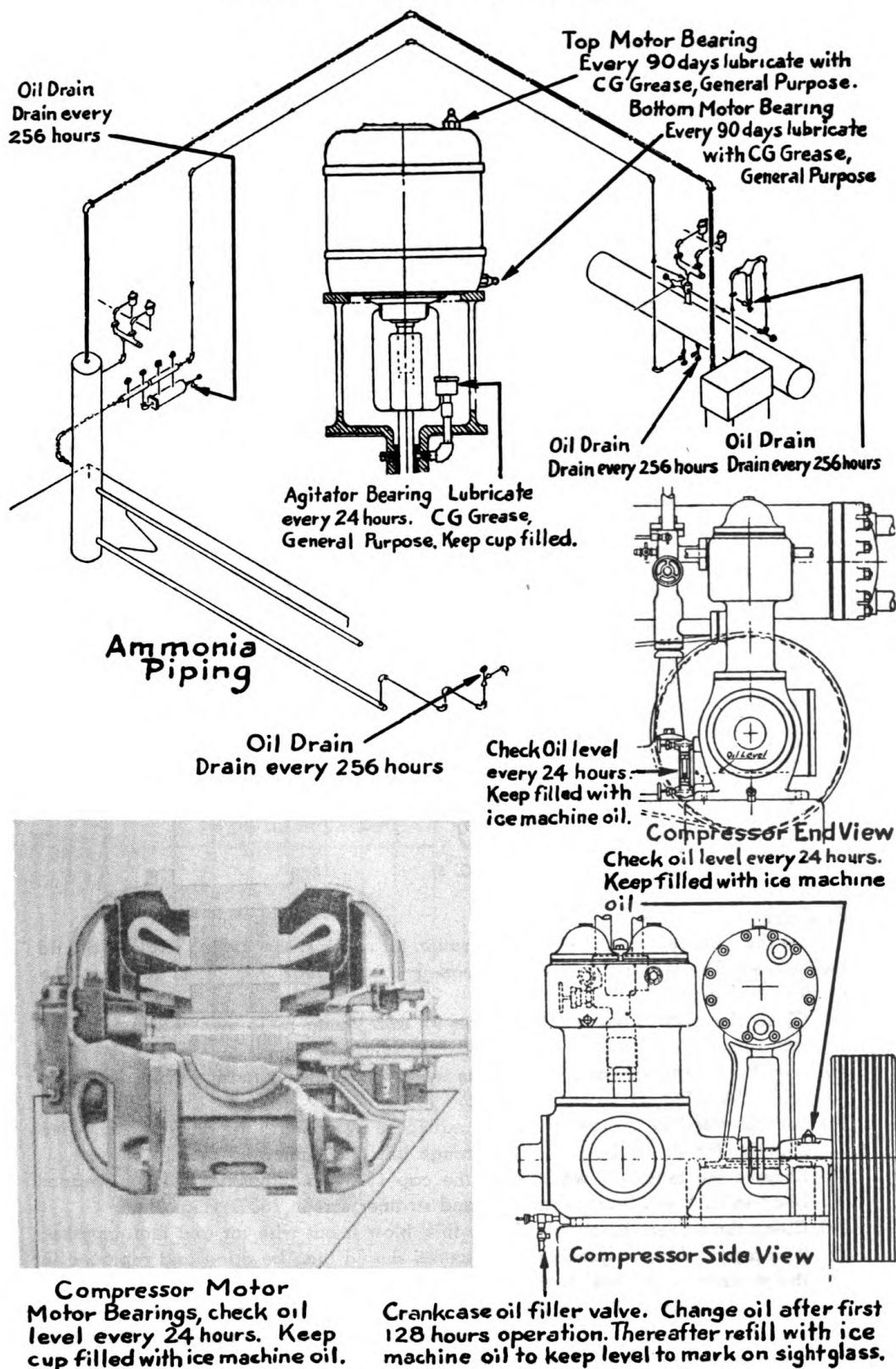


FIG. 4B

The outboard bearing (579) should be filled with Yorkco Ammonia Compressor Oil at intervals as required.

#### D. Adding Oil to Crankcase

To add fresh oil to the crankcase, use the hose connection provided for this purpose and attach it to the  $\frac{3}{8}$ -inch steel angle charging valve "F." Close suction valve (B), pump a slight vacuum in the crankcase, insert the hose connection to the bottom of the oil container, and open the oil charging valve. The oil will then be sucked into the crankcase. Use care to close the charging valve before the end of the hose is entirely uncovered so as to prevent air entering the compressor.

#### E. Cylinder Wall Lubrication (Fig. 31)

Cylinder wall lubrication for these compressors is automatic. Oil from the internal oiling system for the bearings is piped, through an orifice fitting at the stuffing box, to the inlet side of an oil drip valve (1057). The outlet from the drip valve goes to a distributor (1058) from which it is piped to the cylinder walls.

Fig. 5 shows a section through the sight drip valve. By means of the needle adjustment the rate of oil feed can be regulated to suit the conditions of operation.

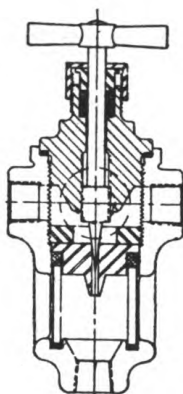
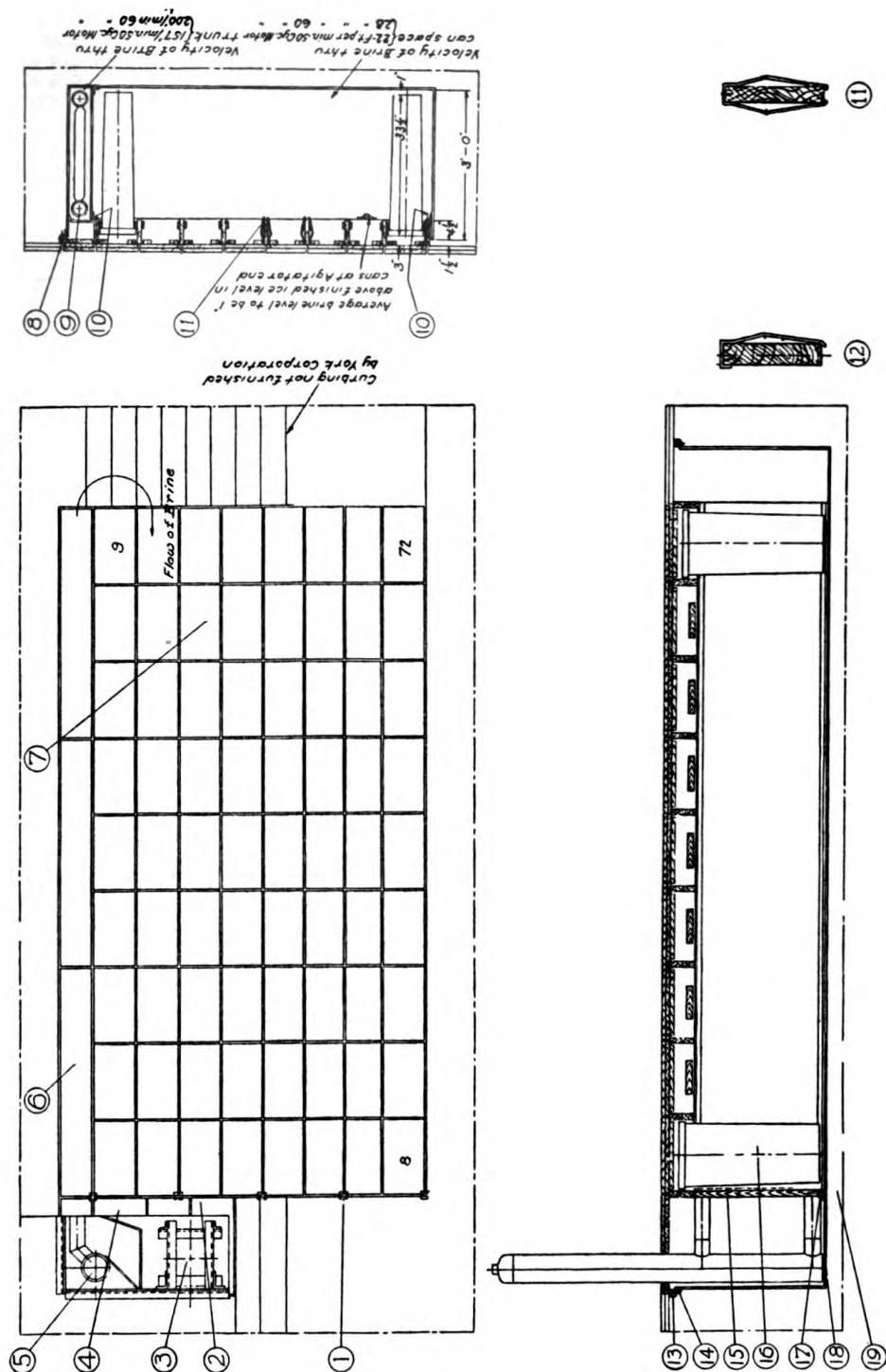


FIG. 5

#### F. Care

After the compressor has been in operation for a week, the suction strainer should be cleaned. The strainer should be cleaned once a year thereafter. To clean the suction strainer:

- (a) Close the suction valve (B) (page 9) and pump a 15-inch vacuum in the crankcase.
- (b) Stop the compressor and, as soon as the flywheel comes to rest, close discharge valve "A" (Fig. 3).
- (c) Test the vacuum in the compressor crankcase by opening the oil charging valve slightly. Air should be pulled in through this connection.
- (d) Remove the four nuts which hold the cap (568) to the bottom of the strainer body (694A) and remove the cap and strainer screen (539) (Fig. 31).
- (e) Clean the screen thoroughly. To do this, blow it out with air and then immerse it in a pail of clean gasoline. The screen should then be dried and replaced in the strainer body (694A) and the strainer cap bolted fast.
- (f) With the suction "B" and discharge valves "A" closed, and valve "C" open, start the compressor and pump a 25-inch vacuum in the crankcase. Then stop the compressor and immediately close valve "C."



225708 O - 52 - 3

FIGURE 6 PART

- Parts**
- 1 Oak Posts,  $1\frac{1}{4}$ " x 2", 2'-5 $\frac{1}{2}$ " lg.
  - 2 Oak Agitator Cover, S-435254
  - 3 Agitator Support, S-435983
  - 4 Oak Suction Trap Cover, S-435254
  - 5 Vertical Suction Trap, S-435205
  - 6 Oak Trunk Covers, S-435254
  - 7 Oak Can Covers, S-435254
  - 8 Oak Strip,  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " x 17'-0" lg.
  - 9 Evaporator Coil, S-435205
  - 10 Stud Bolts,  $\frac{1}{4}$ " x 6"

- Parts**
- 11 Can Holding Down Springs, Symbol 636708
  - 12 Can Holding Down Springs, Symbol 636709
  - 13 Oak Strip  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " x 13'-0" lg.
  - 14 Carriage Bolts,  $\frac{3}{4}$ " x 2"
  - 15 Screen, Galvanized Wire
  - 16 Ice Cans, 8" x 16" x 33 $\frac{1}{2}$ " / 33
  - 17 Oak Post Rest,  $1\frac{1}{4}$ " x 2" x 6'-11" lg.
  - 18 Freezing Tank, S-435204
  - 19 Insulation, Corkboard

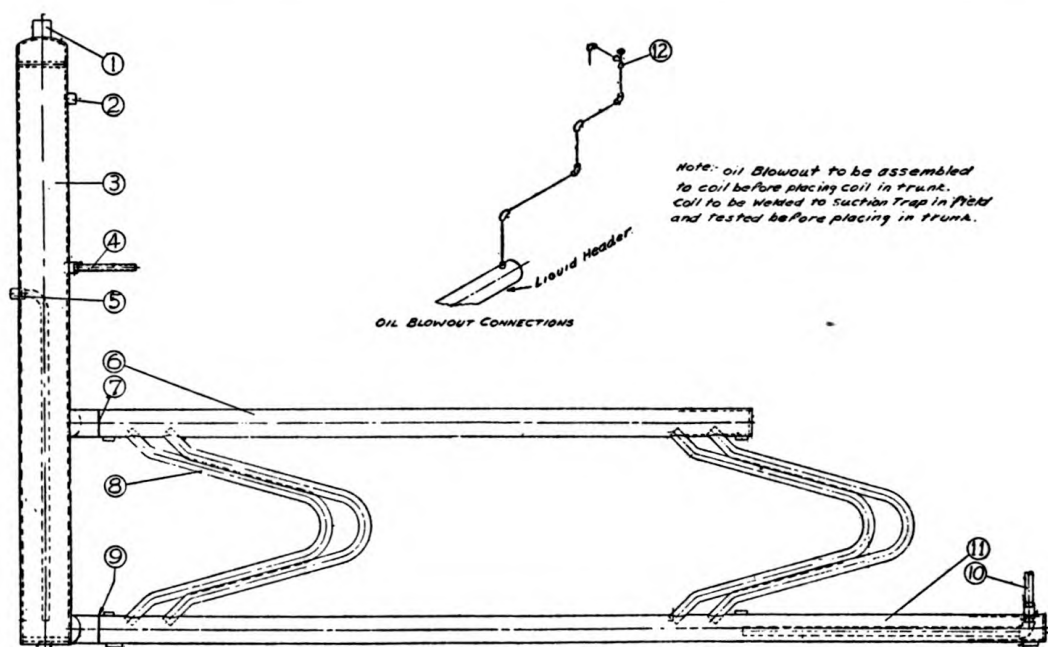


FIG. 7

- Parts**
- 1 Suction Outlet
  - 2 Coupling, Pat. Plate
  - 3 Suction Trap
  - 4 Tell Tale
  - 5 Liquid Inlet
  - 6 Coil Top Header

- Parts**
- 7 Field Weld, Top Header
  - 8 Pipe Coils
  - 9 Field Weld, Bottom Header
  - 10 Oil Blowout
  - 11 Coil Bottom Header
  - 12 Oil Blowout Valve

## FREEZING TANK ASSEMBLY

The freezing tank assembly consists of a number of pieces that must be assembled at the ice plant building site.

The tank itself is of black steel and the sheets are shipped ready for welding in the field. Before starting erection the engineer must refer to the instructions for installation, and York drawing S435204Y.

The freezing tank coils are the York patented vertical trunk type, built into one side of the freezing tank and enclosed in a steel raceway. The coil consists of a top and bottom header with closely nested coils welded into each, as shown on drawing S435205Y. A vertical suction trap is furnished to prevent liquid ammonia from slopping back on to

the compressor, and this trap must be welded to the top and bottom headers of the coil in the field.

The oak framework and covers for holding the ice cans in place in the tank is shown on drawing S435206Y. In order to save shipping space the framework—consisting of 10

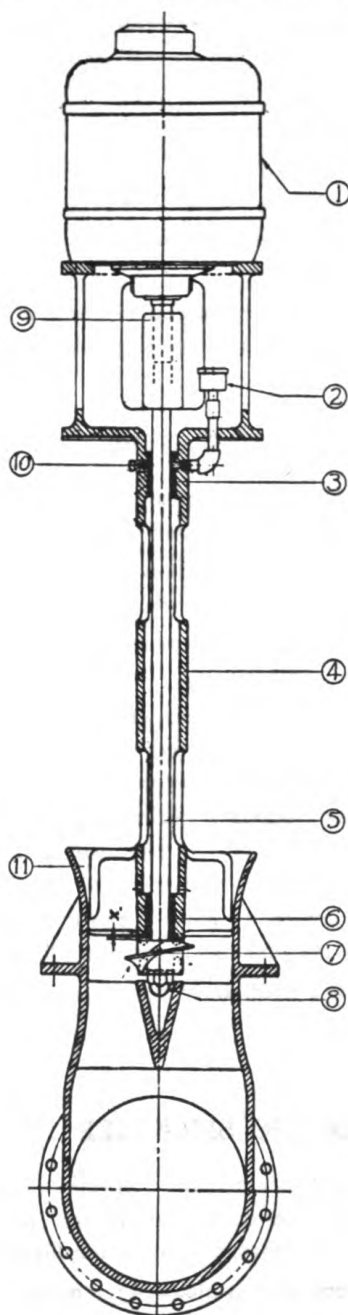


FIG. 8

# 8" VERTICAL AGITATOR

## Parts

- 1 Motor, 1½ H.P. Howell
- 2 Grease Cup
- 3 Bearing, Upper
- 4 Housing, Pattern A-6083-B
- 5 Agitator Shaft
- 6 Bearing, Lower
- 7 Impeller, 8" Bronze, Pattern 7655-F
- 8 Nut, Brass, Pattern 5839F
- 9 Coupling, Pattern 5838G
- 10 Set Screw, ⅜"
- 11 Agitator Funnel, Pattern 5916G

stringers marked (16), and 81 oak fill pieces marked (17) and (18), per drawing S435254Y—are packed together and must be assembled on the job. Refer to drawing S435254Y for complete instructions.

The 72 oak can covers, the trunk covers and agitator cover are made up ready for use.

Each stringer (17) and (18) must be bolted by means of  $\frac{1}{4}$ " x 6" stud bolts to the longitudinal angles marked (7) and (15), drawing S435204Y. The framework must be nailed together before bolting in place in the tank.

The brine agitator is mounted vertically between the end of the tank and the framework, and direct connected to a Howell  $1\frac{1}{2}$  H.P. motor. A more detailed description of the agitator and motor follows.

A single automatic rocking sprinkler type can dump is furnished for harvesting the ice from the cans, located as shown on drawing 435267Y.

The method used in pulling the ice from the tank is by means of a portable hoist, arranged to be wheeled across the top of the can covers. The truck is equipped with two vertical members with a cross bar and chain hoist suitable for lifting a single 100-pound can.

The tank is arranged to contain 72 8" x 16" x 33"/33½" ice cans having a nominal capacity of 100 pounds of opaque ice each.

## VERTICAL AGITATOR

The 8" vertical agitator shown in Fig. 8 is made up of three main parts: the motor, the agitator housing and the funnel.

The motor is described in more detail in these instructions and will be treated as a separate item.

In erecting the agitator the funnel (11) must first be bolted to the trunk, leveled and bolted to the supports.

After the tank has been filled with water for mixing brine and all cans are in place the agitator housing with top plates, shaft and impeller should be set, leveled and bolted in place. Before the agitator is secured it is necessary to mount the motor and check the clearance between the agitator blade and the lower shaft bearing (6). To do this, bolt the motor to the base, bolt the motor and agitator shafts together and tighten the set screws in coupling (9). Place a pry bar under the shaft coupling and force the motor rotor to its highest position. There should be  $\frac{1}{8}$ " clearance between bottom of housing (4) and top of runner (dimension "X").

The top shaft bearing grease cup (2) must be filled with grease and given a turn every day.

## AUTOMATIC SPRINKLER TYPE CAN DUMP

The automatic rocking sprinkler type can dump shown in Fig. 9 is designed to fit the 100-pound ice cans used in this plant. Materials used in its construction are heavy enough to withstand rough handling, and with a little care its life will be indefinite.

The can with a block of ice frozen in it is set on the dump in the vertical position, and released from the hoist. The dump is tilted to the left and as the can falls valve (11) opens and admits water to the sprinkler pipes (5) on each side of the dump. In a few minutes the ice will thaw loose from the can and be released; the dump is then rocked back to the vertical position and the empty can removed.

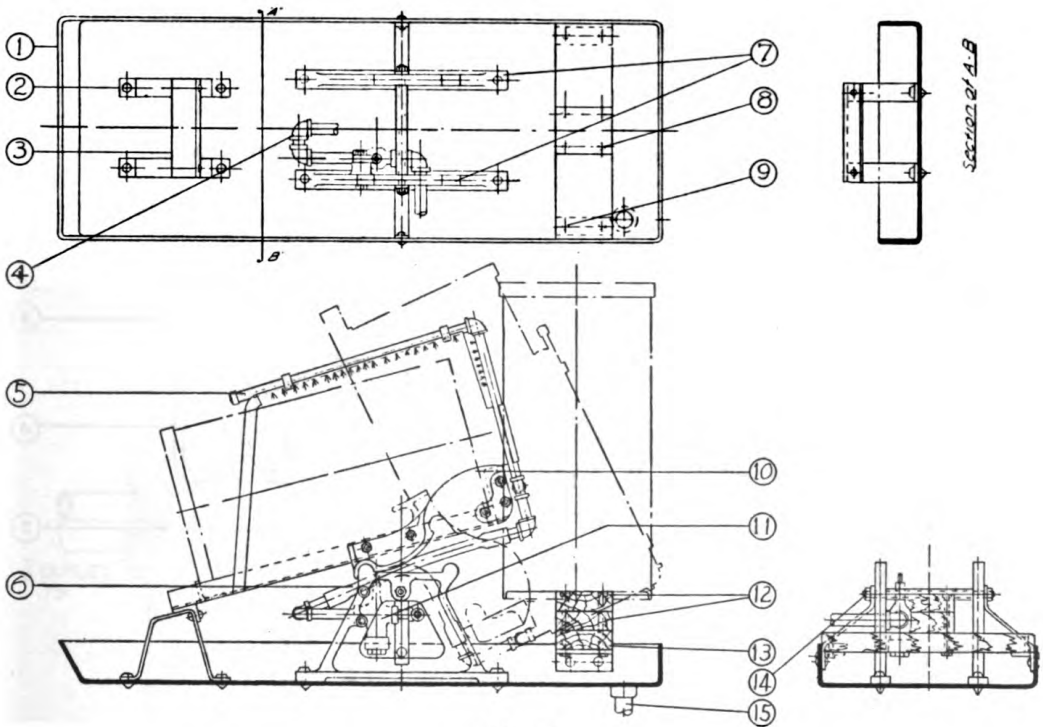


FIG. 9

## Parts

- 1 Steel Pan
- 2 Guides, Flat Iron
- 3 Rocker Angle Rest
- 4 Elbows,  $\frac{3}{4}$ "
- 5 Sprinkler Pipes
- 6 Hose Connection
- 7 Rocker Support, Cast Iron
- 8 Carriage Bolts,  $\frac{3}{8}$ " x 6"

## Parts

- 9 Carriage Bolts,  $\frac{3}{8}$ " x  $2\frac{1}{2}$ "
- 10 Rockers, 1634-35G
- 11 Valve,  $\frac{3}{4}$ ", 6092F
- 12 Oak,  $1\frac{1}{8}$ ", 5" x 6"
- 13 Oak,  $1\frac{1}{8}$ ", 6" x 20"
- 14 Bolt,  $\frac{5}{8}$ " x  $13\frac{1}{4}$ " Stud
- 15 Drain

## ICE CAN HOIST AND FILLER

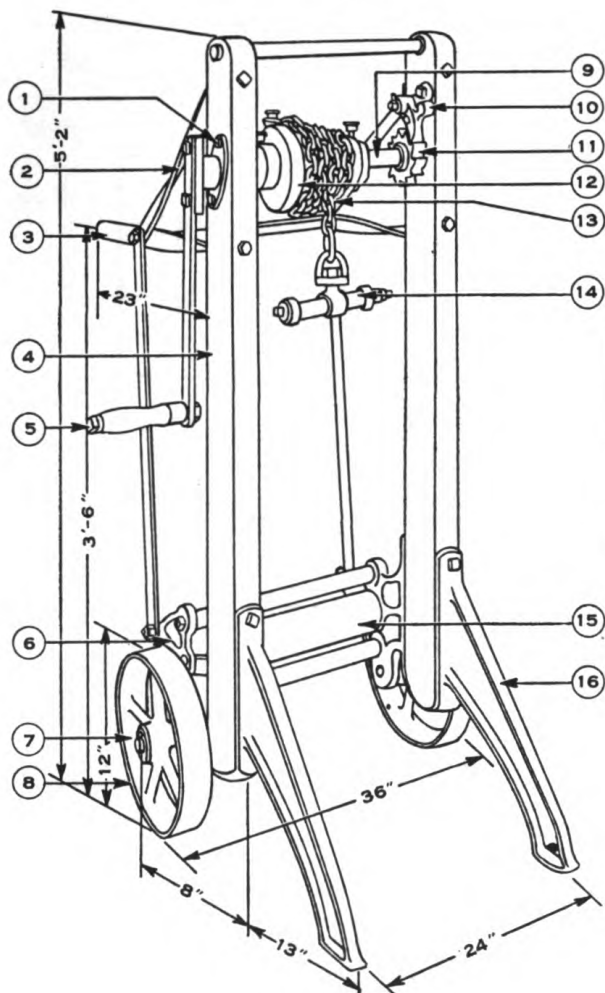


FIG. 10  
ICE CAN HOIST (FIG. 10)

## Parts

- 1 Bronze Bearing
- 2 Crank Handle Bracket
- 3 Half Iron Handle
- 4 Maple Standard
- 5 Wood Handle
- 6 Rear Bracket
- 7 Roller Bearings
- 8 12" Wheel
- 9 Shaft
- 10 Pawl and Bracket
- 11 Ratchet Wheel
- 12 Chain Drum
- 13 Chain,  $\frac{1}{4}$ " Straight Link
- 14 Can Dog
- 15 Wood Roller
- 16 Front Bracket

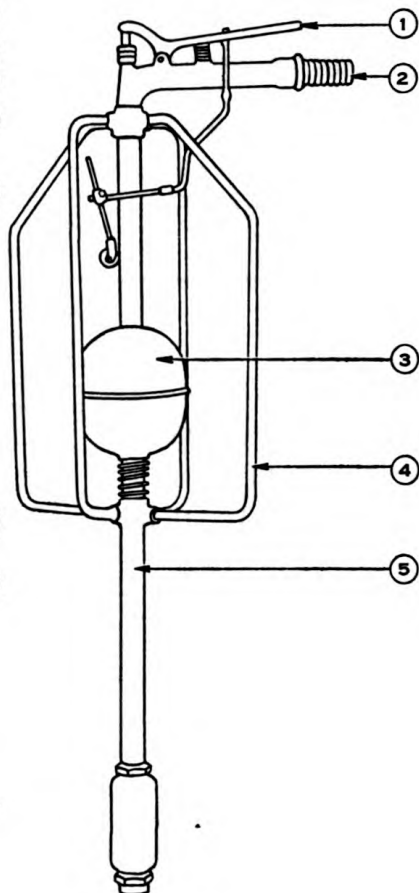


FIG. 11  
ICE CAN FILLER (FIG. 11)

## Parts

- 1 Quick Opening Valve
- 2 Hose Connector
- 3 Float Ball
- 4 Can Guide
- 5 Support

## AMMONIA FLOAT REGULATOR

The York high pressure ammonia float control regulator is an expansion valve.

The regulator as illustrated consists of two main parts: the float body and the float head. The float body is a pot which allows space for liquid ammonia from the condenser to gather, where the level of liquid raises the hollow steel float ball. The float head is a flange bolted to the body, and contains the strainer screen, float ball toggle, valve and valve seat.

Liquid ammonia is drained from the ammonia condenser at high pressure where it fills the float chamber through opening (18), the liquid level causes the float ball to rise and lifts valve (3) from its seat (4). The high pressure liquid passes through the strainer screen (17) and expands through the orifice in the valve seat (4) out to a lower pressure through the channels in the float head to the low side evaporator in the ice tank.

In this manner the float valve keeps the condenser drained of liquid ammonia, and maintains a liquid seal between the condenser and evaporator, in addition to serving as an automatic expansion valve.

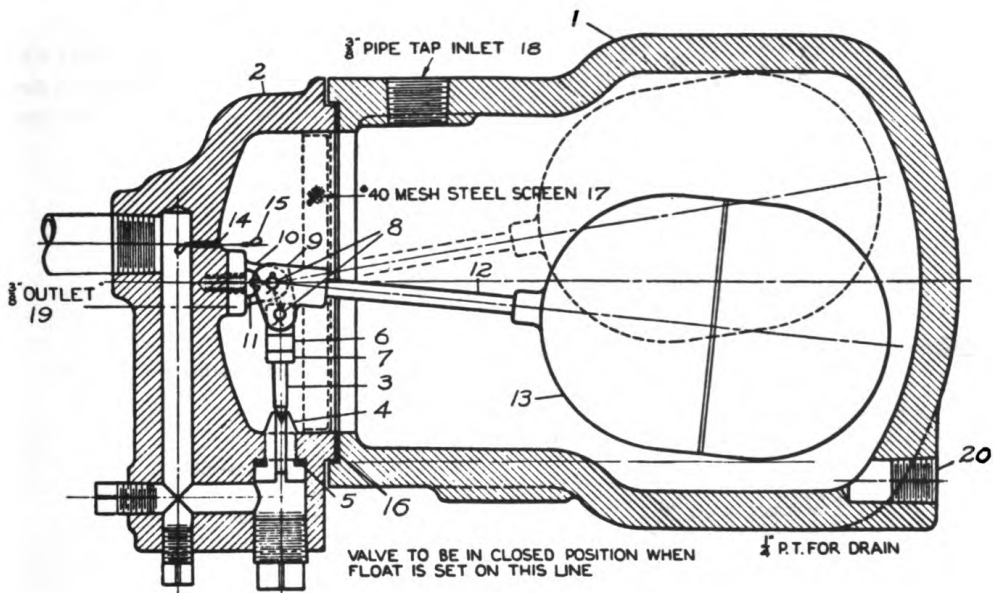


FIG. 12

- | Parts                             | Parts                      |
|-----------------------------------|----------------------------|
| 1 Float Body                      | 11 Toggle Support Screws   |
| 2 Float Head                      | 12 Float Rod               |
| 3 Valve                           | 13 Float Ball              |
| 4 Valve Seat                      | 14 Leaker                  |
| 5 Valve Seat Gasket               | 15 Leaker Restricting Wire |
| 6 Socket Link                     | 16 Head Gasket             |
| 7 Socket Link Lock Nut and Washer | 17 Internal Screen         |
| 8 Pins and Cotters                | 18 Liquid Inlet            |
| 9 Toggle                          | 19 Liquid Outlet           |
| 10 Toggle Support                 | 20 Oil Drain               |

When the float ball is in the lower position the valve (3) is closed, and will assume this position when the compressor shuts down. A small leaker hole is provided in the head, fitted with a leaker wire (15) to prevent the regulator from becoming gas bound. After the compressor shuts down the high pressure side will equalize with the low pressure side through this leaker opening, this equalized pressure aids the compressor motor a great deal when starting up.

## WATER REGULATING VALVE

The regulator shown in Fig. 13 is used on a number of the ice plants included in this contract when the plant is situated in a locality where there is an abundant supply of fresh water under pressure.

The opening and closing of the regulator is controlled by condensing pressure applied to metal bellows (2), forcing open the valve opposed by the spring (9), tending to close the valve. At any given setting of the spring (9), a change of 35 lbs. in condensing pressure is required to move the valve to its full travel.

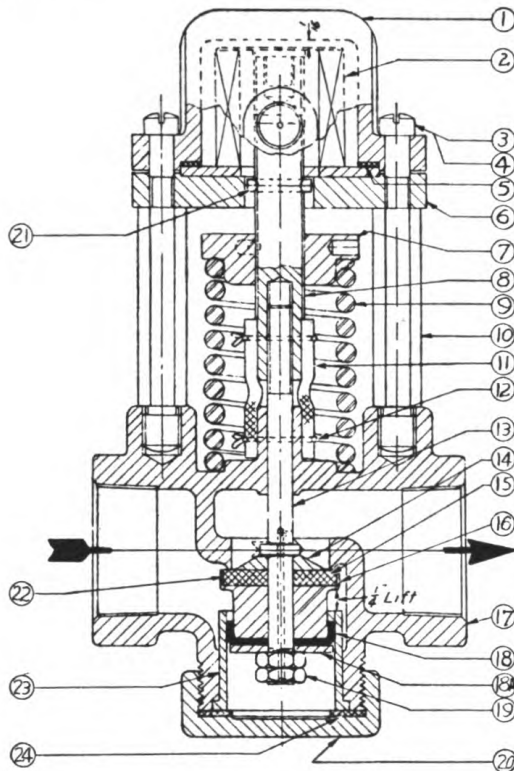


FIG. 13

### Parts

- 1 Bellows Cover
- 2 Bellows
- 3 Screws,  $\frac{5}{16}$ " x 1" Ov. Fillister Head
- 4 Screws,  $\frac{5}{16}$ " x  $1\frac{1}{2}$ " Ov. Fillister Head
- 5 Gasket, Bellows Cover
- 6 Bellows Support
- 7 Nut, Spring Adjusting
- 8 Push Rod
- 9 Spring
- 10 Supporting Stud
- 11 Sleeve
- 12 Brass Wire
- 13 Valve Stem
- 14 Valve Seat Retainer
- 15 Valve Disc
- 16 Valve Disc Retainer
- 17 Valve Body
- 18 Cup Leather
- 18A Washer, for Cup Leather
- 19 Hex. Nuts
- 20 Valve Cover
- 21 Push Rod Pin
- 22 Valve Stem Sub-Assembly
- 23 Valve Guide
- 24 Valve Cover Washer

The condensing pressure running depends on the quantity and temperature of the available water supply and the amount of air in the condenser. The valve is set and tested at the factory to close at 150 lbs. and to open at 185 lbs. pressure.

## MAINTENANCE

If the valve fails to close when the compressor stops, leakage may be due to:

- (a) A cut valve disc or seat.
- (b) Valve blocked open by foreign matter.
- (c) Operating parts improperly adjusted.

If the valve leaks after adjustments have been made, it will be necessary to dismantle the working parts for inspection and repair.

Refer to Fig. 13, and:

- (a) Remove the valve cover (20), and slack off adjusting nut (7) until it has made one revolution after contacting bellows support (6).

- (b) Unscrew valve stem assembly (13) without disturbing brass nuts (19). Valve guide (23) will come out with the stem assembly, unless the guide is badly scaled to the valve body.
- (c) Clean all parts and, if necessary, replace the valve disc (15). Examine and clean the valve seat. Flush the valve body.
- (a) To reassemble, screw stem assembly (13) in about half way.
- (b) With adjusting nut (7), increase the spring pressure until the adjusting nut is  $\frac{3}{4}$ " away from bellows support (6).
- (c) Screw in valve stem (13) until it just touches the seat.
- (d) Slack off adjusting nut (7) until the valve stem can be screwed in two additional revolutions without forcing.
- (e) Assemble valve guide (18), gasket (24), and valve cover (20).
- (f) Turn water on, start the compressor and adjust the regulating spring so that the valve works between the limits outlined.

## DIAPHRAGM TYPE RELIEF VALVES

Two sets of two each of these valves are furnished with dual relief valve assemblies. Two relief valves are located in the ammonia discharge line between the compressor and condenser, with a setting of 250 lbs. Two relief valves are connected at the freezing tank coil suction trap set to relieve pressure at 150 lbs.

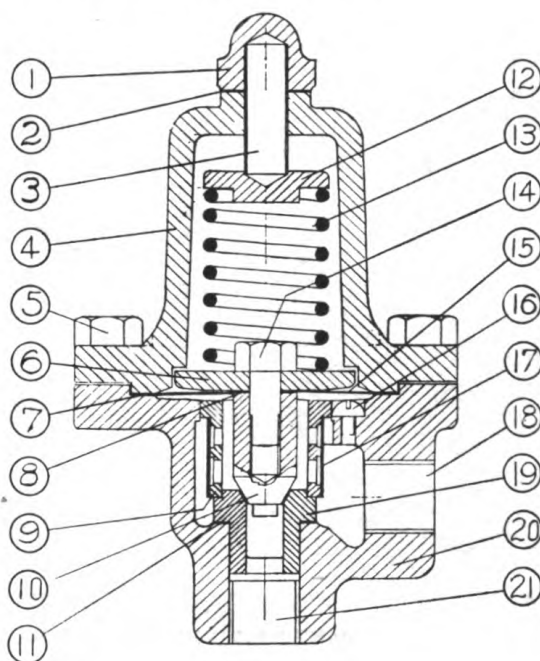


FIG. 14

### PART REFERENCE

#### Parts

- 1 Seal Nut
- 2 Gasket, Metallic Asbestos
- 3 Set Screw,  $\frac{1}{4}$ " x  $1\frac{1}{2}$ "
- 4 Cover, 8628F
- 5 Cap Screws,  $\frac{3}{8}$ " x  $\frac{7}{8}$ "
- 6 Spring Support
- 7 Gasket
- 8 Gasket
- 9 Screen Support
- 10 Valve
- 11 Gasket

#### Parts

- 12 Spring Cap
- 13 Spring
- 14 Valve Screw
- 15 Diaphragm
- 16 Screw, Rd. Hd. No. 10—24 x  $\frac{1}{4}$ " Lg.
- 17 Strainer Screen
- 18 Inlet,  $\frac{1}{4}$ " P.T.
- 19 Valve Seat
- 20 Valve Body, 8627-F
- 21 Outlet,  $\frac{1}{4}$ " P.T.

The valves should be set vertically with the diaphragm cap up. Connect pressure to the side inlet with the bottom outlet down, and make up the threaded pipe joints with oil and graphite applied to the nipple threads.

These valves will reseal themselves after the pressure on the inlet drops below the valve setting. If any of the valves should develop a leak, it should be replaced with a new one and the old valve returned for adjustment or repair.

## WATER PIPING

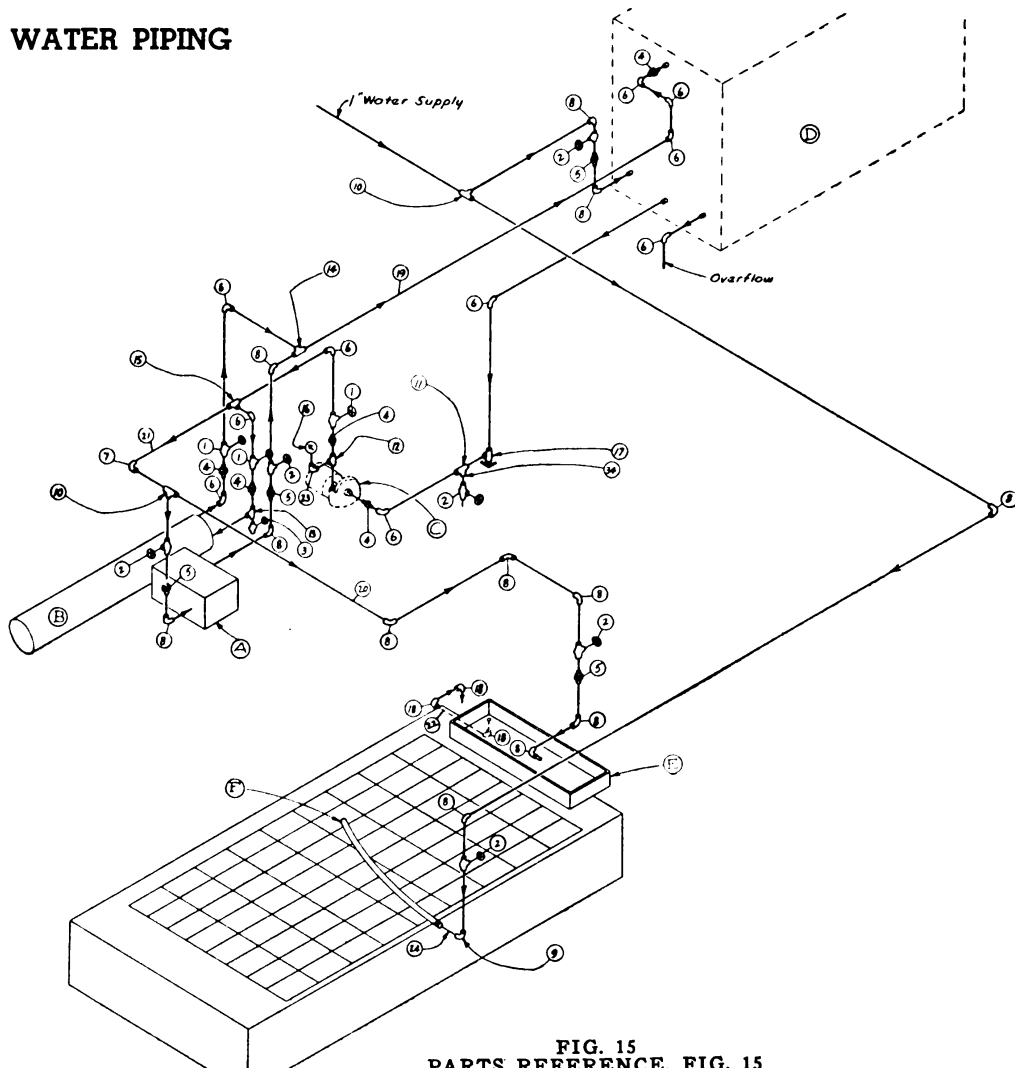


FIG. 15  
PARTS REFERENCE, FIG. 15

- Parts
- 1 2" Brass Gate Valve
  - 2 3/4" Brass Gate Valve
  - 3 1/2" Brass Gate Valve
  - 4 2" Box Unions
  - 5 3/4" Box Unions
  - 6 2" Scrd. Elbows
  - 7 1" Scrd. Elbows
  - 8 3/4" Scrd. Elbows
  - 9 3/4" x 1" Scrd. Elbows
  - 10 1" x 3/4" x 3/4" Scrd. Tee
  - 11 2" x 2" x 2" Scrd. Tee
  - 12 2" x 1 1/2" x 1/4" Scrd. Tee
  - 13 2" x 1/2" x 2" Scrd. Tee
  - 14 2" x 3/4" x 2" Scrd. Tee
  - 15 2" x 1" x 2" Scrd. Tee
  - 16 0 lb. to 100 lb. Water Pressure Gauge

- Parts
- 17 2" Water Strainer
  - 18 1 1/2" Scrd. Elbow
  - 19 2" F.W. Pipe
  - 20 3/4" F.W. Pipe
  - 21 1" F.W. Pipe
  - 22 1 1/2" F.W. Pipe
  - 23 1/4" Scrd. Elbow
  - 24 1" F.W. Nipple
  - 34 2" x 3/4" Bushing
- EQUIPMENT REFERENCE, FIG. 15
- A—Compressor
  - B—Condenser
  - C—Water Pump 35 GPM-60' Hd. By Others)
  - D—Cooling Tower, Forced Draft (By Others)
  - E—Sprinkling Type Can Dump
  - F—1 1/4" Hose to Can Filler

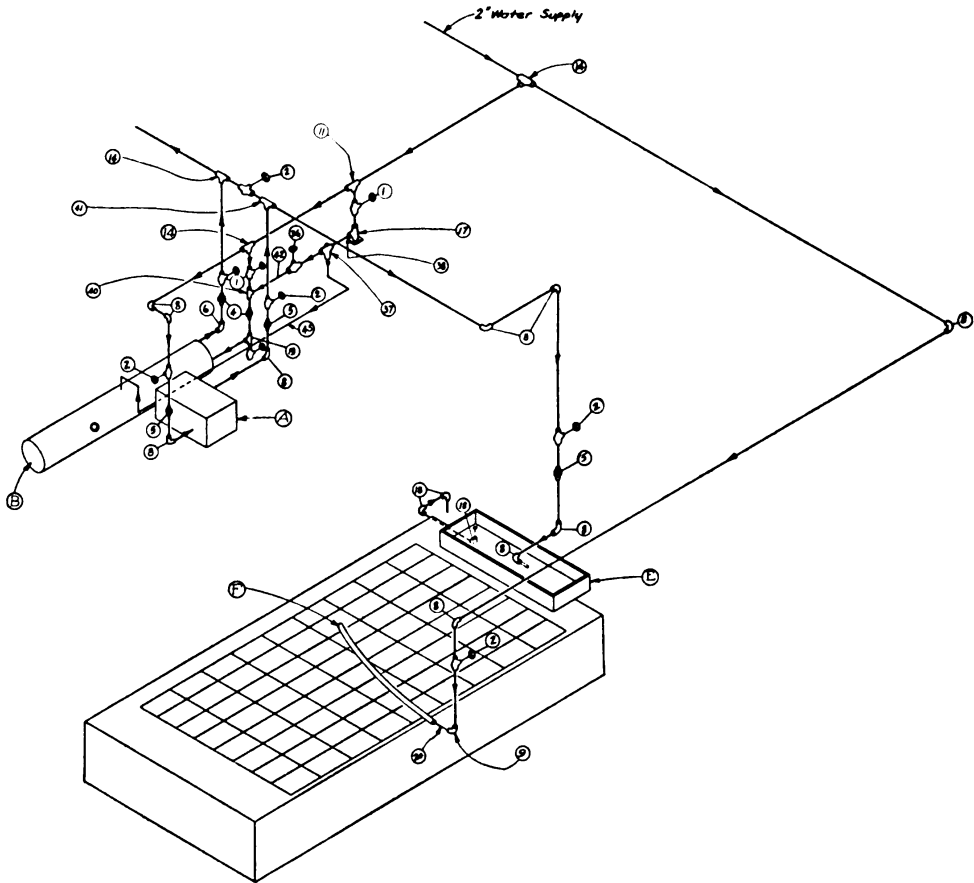


FIG. 16  
PARTS REFERENCE, FIG. 16

Parts  
1 2" Brass Gate Valve  
2 3/4" Brass Gate Valve  
3 1/2" Brass Gate Valve  
4 2" Box Unions  
5 3/4" Box Unions  
6 2" Screwed Elbows  
8 3/4" Screwed Elbows  
9 1" x 3/4" Scrd. Elbow  
11 2" x 2" x 2" Scrd. Tee  
13 2" x 1/2" x 2" Scrd. Tee  
14 2" x 3/4" x 2" Scrd. Tee  
17 2" Water Strainer  
18 1 1/2" Scrd. Elbow

Parts  
24 1" F.W. Nipple  
36 1 1/4" Brass Gate Valve  
37 1 1/4" Water Regulating Valve  
38 2" x 1 1/4" Bushing  
40 2" x 2" x 1 1/4" Scrd. Tee  
41 3/4" x 3/4" x 3/4" Scrd. Tee  
42 1 1/4" F.W. Nipple  
45 H.P. Connection to Condenser  
EQUIPMENT REFERENCE, FIG. 16  
A—Compressor  
B—Condenser  
E—Sprinkler Type Can Dump  
F—1 1/4" Hose to Can Filter

## LOW PRESSURE AMMONIA CUT-OUT

Fig. 17 illustrates the low pressure cut-out switch used for stopping the compressor when the plant suction pressure drops to the desired setting.

The switch is located on the side of the compressor motor starter box with the threaded male bottom connection piped into the low pressure side of the ammonia system. Electrically the instrument is wired in series with the high pressure cut-out and the starter control system, indicated as (6) on wiring diagram Fig. 21.

Pressure is admitted to a Bourdon steel tube which actuates the tripping of the one Mercoid tube through expansion and contraction. Two pointers on a scale indicate the high and low setting of the instrument; this setting should not be tampered with, as the system will operate correctly as set at the factory. The top arrow indicates the cut-in pressure, the lower arrow, the low pressure cut-out.



FIG. 17

After the switch trips, the compressor cannot be started until the instrument has been reset by hand, by means of the switch on the outside of the case.

The Mercoid tube is replaceable in case of damage.

### HIGH PRESSURE AMMONIA CUT-OUT

The high pressure control switch shown in Fig. 18 is located on one side of the compressor motor starter box and indicated as (7) on wiring diagram Fig. 21.

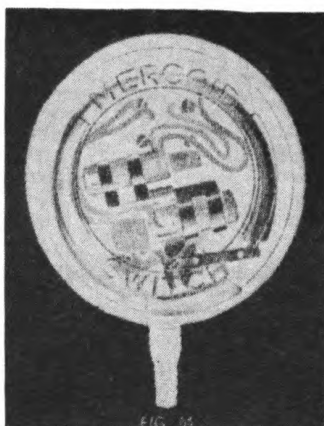


FIG. 18

The instrument has a threaded male bottom connection which is tied into the high pressure side of the ammonia system. Pressure is admitted into a heavy steel Bourdon tube that actuates the tripping of the two Mercoid bulbs through expansion of the tube. The top tube is wired into the alarm circuit and when tripped makes connection to ring the bell; the bottom tube is wired into the control circuit to stop the compressor when the condensing pressure reaches 250 p.s.i.

After the switch stops the compressor it must be reset by hand by means of the small switch on the bottom of the case.

If damage occurs to the instrument the two bulbs can be replaced by disconnecting the four wires and removing the damaged tubes from their holders.

### CARTRIDGE TYPE RELIEF VALVE

The cartridge type relief valve (item 458, Fig. 31), located in the compressor valve manifold, is set to relieve excess pressure from the ammonia discharge to the suction side. Normally this valve will never be called into use, since the ammonia high pressure cut-out switch will stop the compressor before the relief valve setting is reached.

Fig. 19 shows details of the working parts of this valve, consisting of a steel ball (4) lapped into a steel seat (5), held in place by a steel spring (2) and nut (1). The spring

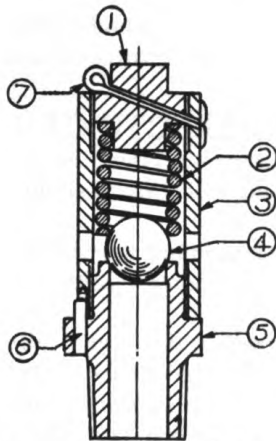


FIG. 19

## Parts

- 1 Adjusting Nut
- 2 Spring
- 3 Valve Cage
- 4 Steel Ball
- 5 Steel Valve Seat
- 6 Dowel
- 7 Cotter Pin

is factory set to withstand a definite pre-determined pressure, and the setting must not be changed.

It is not necessary to remove the cartridge and reseal the valve after one "popping," the valve will stand several poppings without reseating.

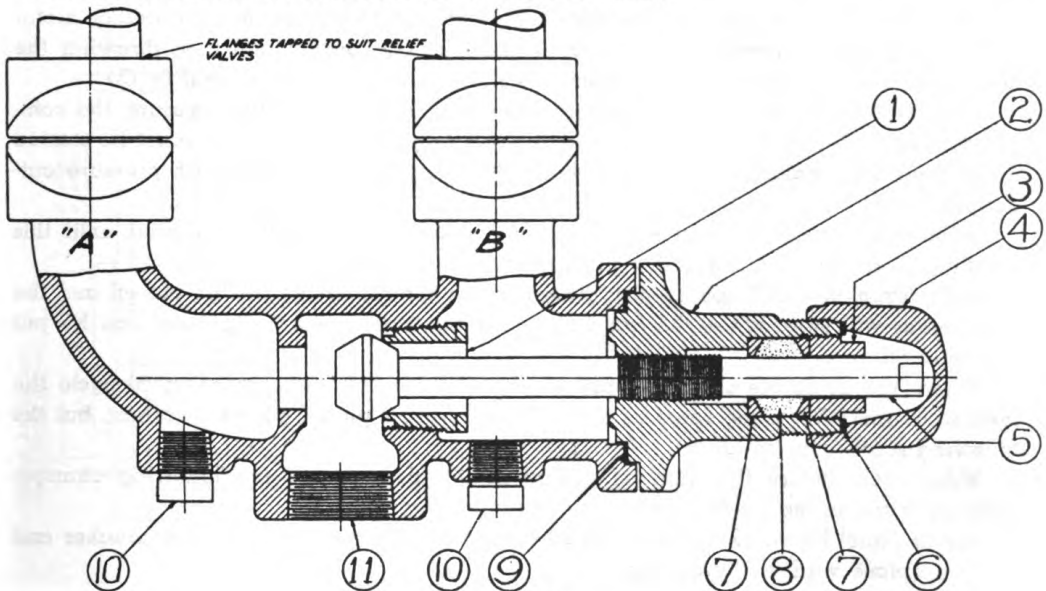


FIG. 20

## Parts

- 1 Bushing
- 2 Valve Bonnet
- 3 Packing Nut
- 4 Valve Cap
- 5 Valve Stem
- 6 Gasket Valve Cap

## Parts

- 7 Packing Washers
- 8 Packing
- 9 Gasket, Bonnet
- 10 Pipe Plug, 1/2"
- 11 Valve Inlet
- A-B Valve Outlets

**DUAL RELIEF VALVE ASSEMBLY**

Fig. 20 illustrates the dual stop valve arrangement used ahead of the diaphragm type relief valves.

The arrangement of the stop valve is such that only one relief valve may be shut off at any time.

Back-seating valve stem (5) (turning it counter-clockwise as far as it will go) admits pressure to connection "A," and isolates "B."

Turning valve stem (5) clockwise as far as it will go admits pressure to connection "B" and isolates "A."

With valve stem (5) open half-way, pressure is admitted to both outlets "A" and "B."

This arrangement makes it possible to remove one relief valve at a time for repairs or testing, and still leaves one valve in service.

## STARTING OPERATION, ELECTRICAL

Figs. 2-3, pages 9-11, contain a diagram of the ammonia piping for these installations with the valves lettered for reference, and this should be carefully studied before any of the electrical equipment is started up.

Figs. 15-16, pages 26-27, show two methods of connecting the water mains for these plants with the operating valves indicated, and the correct setting of these valves should be noted.

For plants using 208 volt, 3 phase, 60 cycle current with a water pump and cooling tower, the electrical equipment operates in the following sequence: (Fig. 21).

Close the main disconnect switch (1) and the circuit breakers in panel (2). Before the compressor motor (10) can be started disconnect switch (15) must be closed and starters (11) and (12) for the pump motor and cooling tower fan motor must be on and motors (13) and (14) operating. When the starter (11) is in its running position the control circuit through the Mercoid high pressure (7) and the low pressure cut-out switch (6) are supplied with current and the compressor motor may be started. Start the agitator motor (9) by pressing the push button starter (3). Start the compressor motor (10) last by pulling lever on starter (5) to the starting position and then throwing the lever to its running position which energizes the low voltage holding coil in (5).

If the high pressure cut-out switch cuts out due to high condensing pressure, the compressor only will stop and the alarm bell (8) will ring. The compressor cannot be started again until the pressure is brought down to its normal level and the high pressure cut-out switch (7) reset.

If the compressor stops on account of low pressure, it cannot be started until this condition is corrected and the low pressure cut-out (6) reset.

If the fan motor (13) should stop, power to the control circuit will be cut off and the compressor will stop. When the fan motor is again started the compressor can be put in operation.

Where the available power supply for the plant is 400 volts, 3 phase, 50 cycle the method of operation is the same as stated for 208 volt, 3 phase, 60 cycle current, but the following steps must be taken:

**WARNING:** Before the plant is placed in initial operation the following changes must be made in the power circuit:

- (a) In panel board (2) remove the 90 amp. trip from the 20 H.P. circuit breaker and replace with a 70 amp. trip.
- (b) Change the compressor, agitator, fan and pump motor connections as shown on the motor nameplates (for 400 volt operation).
- (c) Change heater elements in starter (3) from 6.5 amps. to 3.51 amps.
- (d) Change heater elements in starter (11).
- (e) Change heater elements in starter (12).
- (f) Change primary connection on transformer (4) from terminals 1 and 2 to 3 and 4.
- (g) Change heater elements in starter (5) from S474436 to S760593.
- (h) Change the low voltage holding coil in starter (5) from S261657 to S261658.

Where the ice plant is located so that the source of water supply is from a remote pressure system, the cooling tower and condenser water pump are not required. (Fig. 22.)

When this is the case the six wires and the two lower 15 amps. circuit breakers in (2)

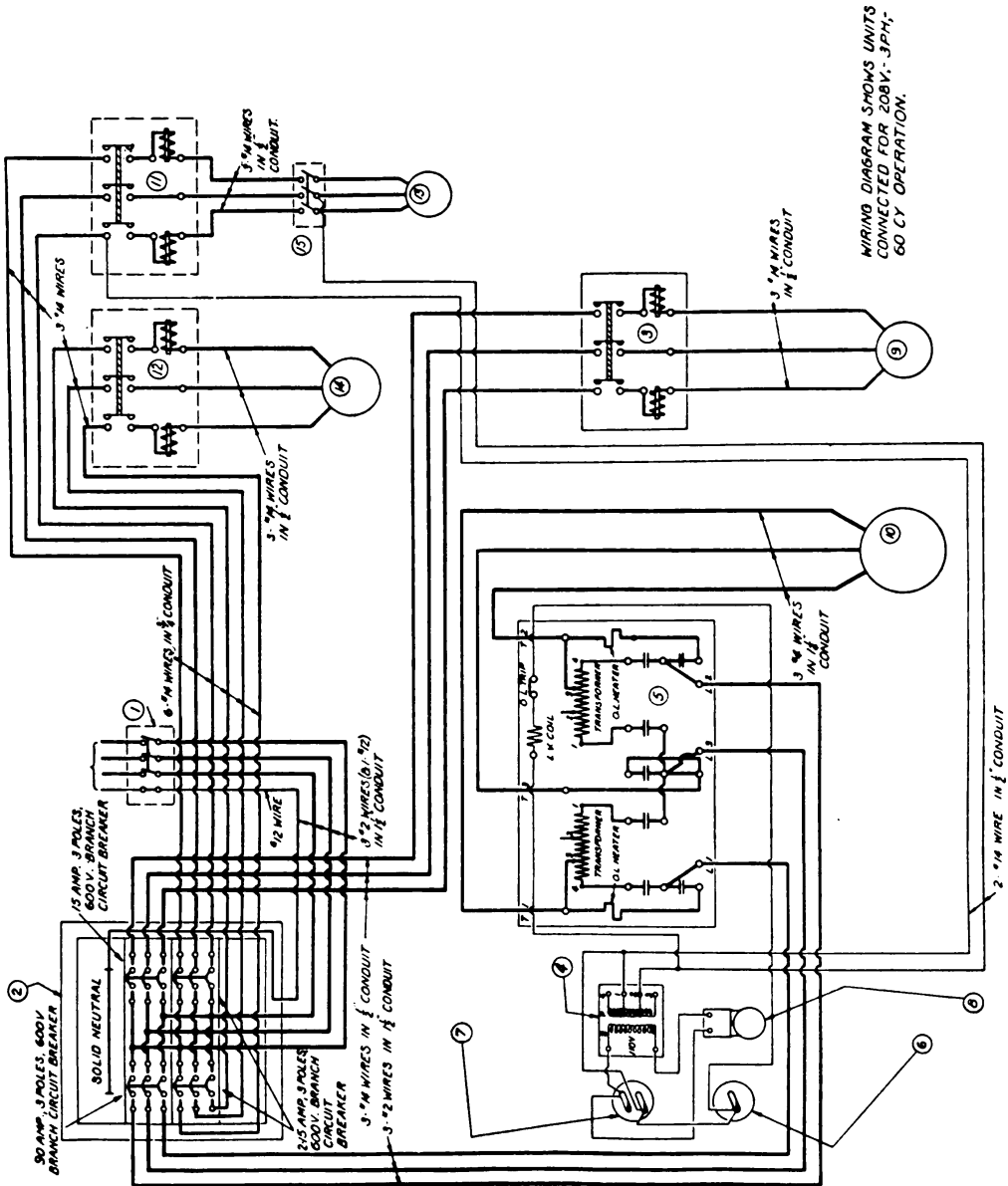


FIG. 21  
REFERENCE PARTS, FIG. 21

## Parts

- 1 Main Disconnect Switch, 208 or 400 Volt
- 2 Circuit Breaker, 208 to 400 Volts, 3 Phase, 4 Wire, 150 Amps. Mains
- 3 Allen Bradley Bulletin 609, Size 0, NEMA Type 1, A.C. Manual Starter. Elements 6.5 Amps. at 25° C.
- 4 Westinghouse Type MT Air Cooled Transformer, 25 Volt Amps., Primary 400 V., 50 Cy. (Term. 3 & 4), 208 V., 60 Cy. (Term. 1 & 2), Secondary 110 V.
- 5 Westinghouse Class 10-700 Size 3, Manual Reduced Voltage Starter
- 6 Mercoid Type DA-61-3 Ammonia L.P. Cut-out, Semi-Automatic with Hand Reset, Single Pole Closes Circuit on Pressure Rise. 3 Amps., 440 V., Tilting Type Switch

## Parts

- 7 Mercoird Figure 61 Ammonia H.P. Cut-out, Semi-Automatic with Hand Reset 1-3 Amp. Alarm Circuit Tilting Type Switch
- 8 Edwards No. 551 Alarm Bell 110 V., 50 to 60 Cycle
- 9 Howell 1½ H.P., 1160 R.P.M., 208-3-6-0; 440-3-50 Vertical Agitator Motor
- 10 Westinghouse Type CS Class 2, 20 H.P., 1750 R.P.M., , 208-3-60; 400-3-50, Compressor Motor
- \*11 Starter for ¾ H.P. Fan Motor
- \*12 Starter for ½ H.P. Pump Motor
- \*13 ¾ H.P. Fan Motor
- \*14 1½ H.P. Pump Motor
- \*15 Disconnect Switch
- \* Not furnished by York

are not needed and are eliminated from the wiring circuit. In addition, the two wires leading to the control circuit should be tied into the middle lower terminal and upper left-hand terminal of starter (3) as shown in Fig. 22. By this method the compressor motor cannot be started until the agitator motor (9) is placed in operation.

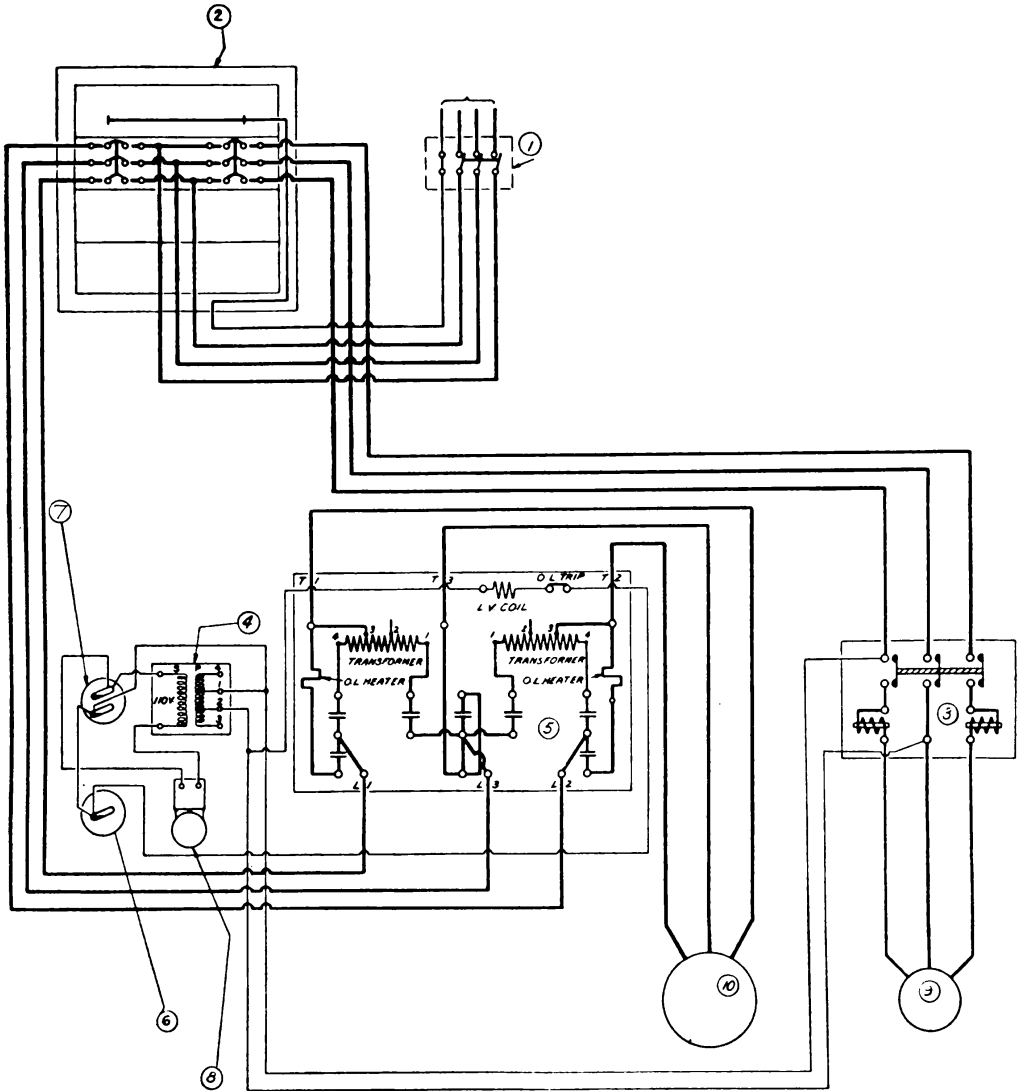


FIG. 22

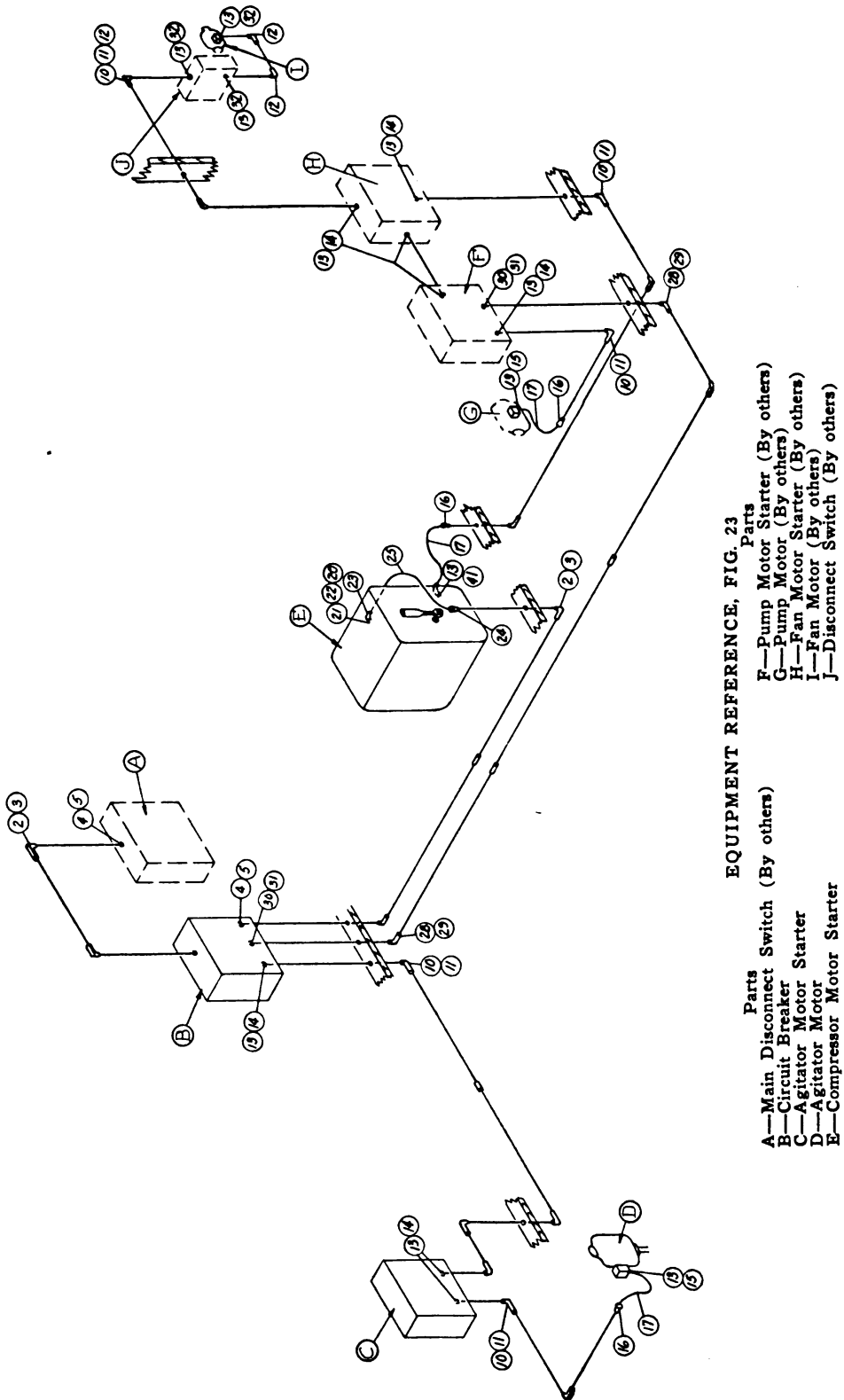
## REFERENCE PARTS, FIG. 22

## Parts

- 1 Main Disconnect Switch, 208 or 400 Volts
- 2 Circuit Breaker, 208 to 400 Volts, 3 Phase, 4 Wire, 150 Amps. Mains
- 3 Allen Bradley Bulletin 609, Size 0, NEMA Type 1, A.C. Manual Starter. Elements 6.5 Amps. at 25° C.
- 4 Westinghouse Type MT Air Cooled Transformer, 25 Volt Ampere, Primary 400 V., 50 Cy. (Term. 3 & 4), 208 V., 60 Cy. (Term. 1 & 2) Secondary 110 V.
- 5 Westinghouse Class 10-700, Size 3, Manual Reduced Voltage Starter

## Parts

- 6 Mercoid Type DA-61-3 Ammonia L.P. Cut-out, Semi-Automatic with Hand Rest, Single Pole Closes Circuit on Pressure Rise. 3 Amps., 440 V. Tilting Type Switch
- 7 Mercoid Figure 61, Ammonia H.P. Cut-out, Semi-Automatic with Hand Rest, 1-3 Amp. Alarm Circuit Tilting Type Switch
- 8 Edwards No. 551 Alarm Bell, 110 V., 50 to 60 Cycle
- 9 Howell 1½ H.P., 208-3-60; 440-3-50 Vertical Agitator Motor
- 10 Westinghouse Type CS Class 2, 20 H.P., 1750 R.P.M., 208-3-60; 400-3-50, Compressor Motor



225708 O - 52 - 5

FIG. 23  
CONDUIT PIPING, FIG. 23

Item	Parts	Item	Parts
2	1 1/2" Condulets LB57	20	2" Bushing
3	1 1/2" Condulet Covers 570	21	2" x 1 1/2" Reducer Bushings RE65
4	1 1/2" Locknuts	22	2" Locknut
5	1 1/2" Bushings	23	1 1/2" 90° Greenfield Connector
10	3/4" Condulets LB17	24	1 1/2" Combination Coupling CMBC-112
11	3/4" Condulets Covers 170	25	1 1/2" Flexible Conduit (3 ft. Piece)
12	3/4" Condulet Cover Gaskets Gask-571	28	3/4" Condulets LB27
13	3/4" Locknuts	29	3/4" Condulet Covers 270
14	3/4" Bushings	30	3/4" Locknuts
15	3/4" Straight Flexible Connectors SC12	31	3/4" Bushings
16	3/4" Combination Coupling CMBC-12	32	3/4" Unions UNY1
17	3/4" Flexible Conduit (2 ft. Pieces)	41	1/2"-90° Angle Connector AC912

COMPRESSOR MOTOR

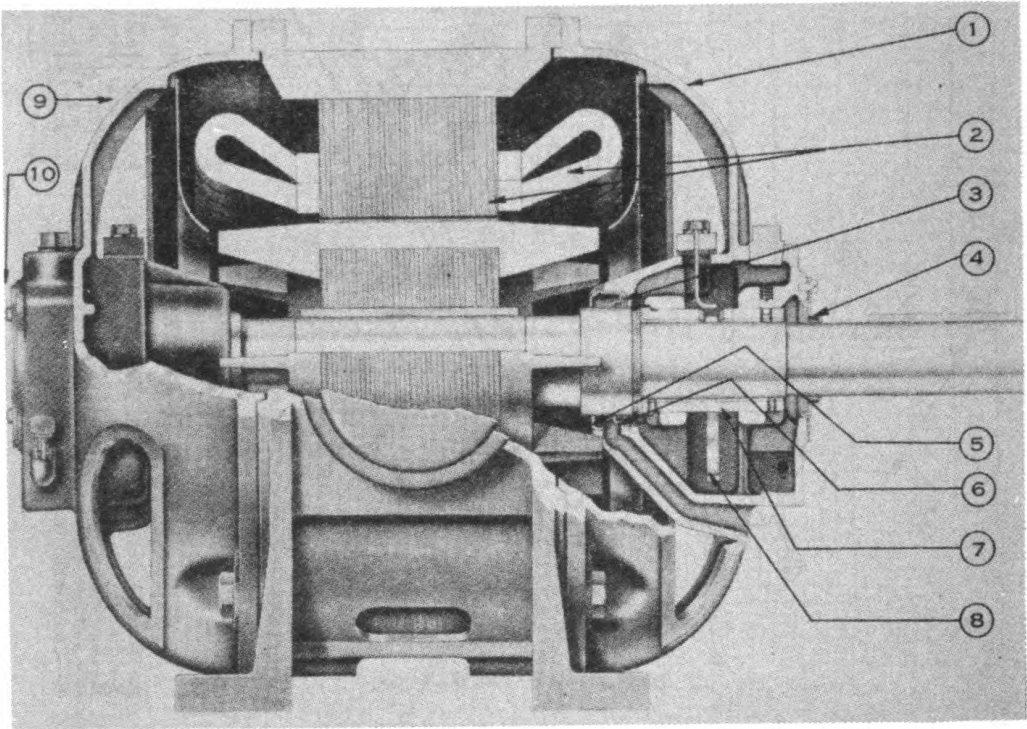
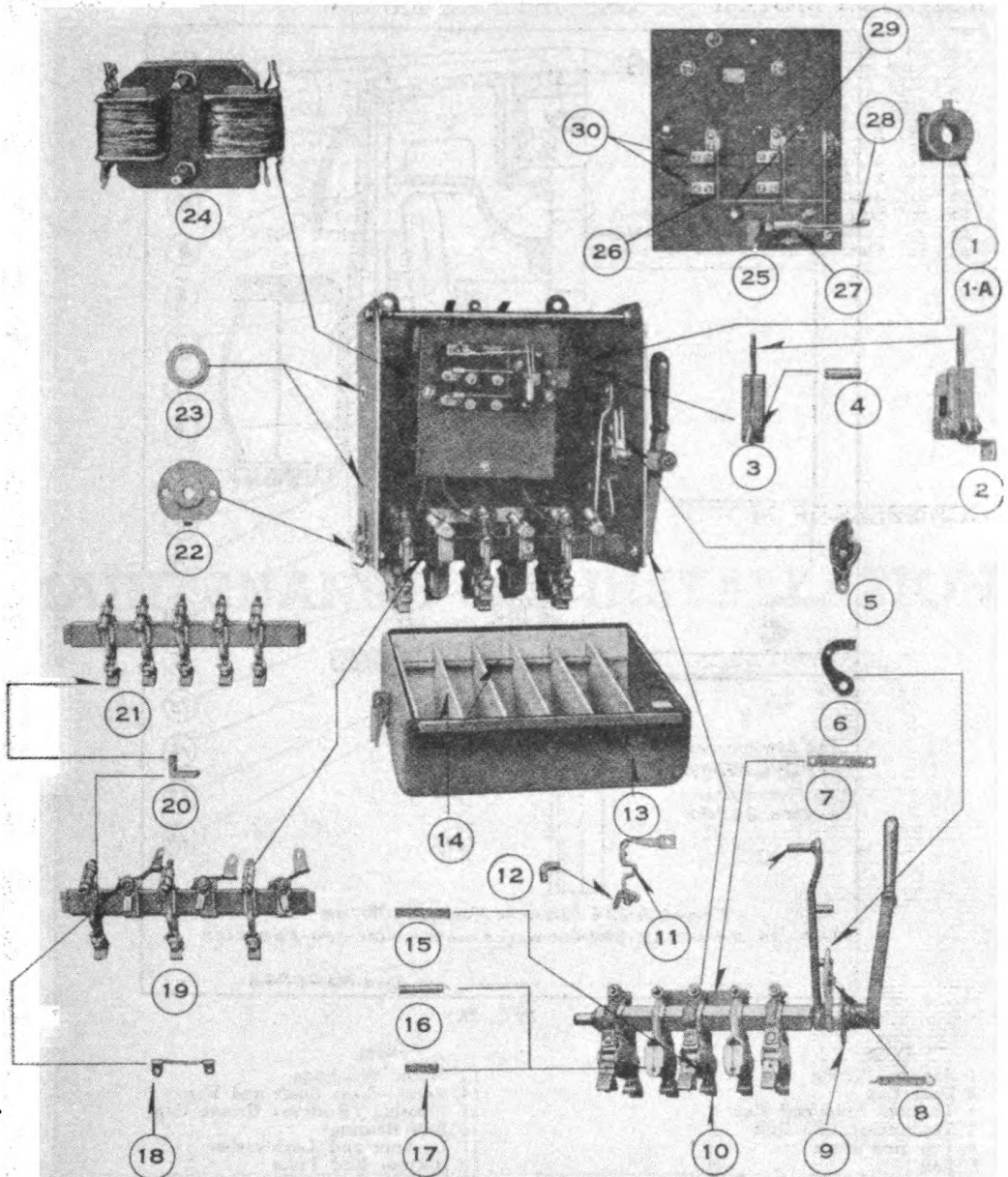


FIG. 24

FIG. 24—20 H.P. MOTOR

Parts	Parts
1 Rear Bracket, 688534B	6 Inner Dust Cap, 779501 (Inside Part)
2 Stator Coils—L Spec. with Cut Insulation 424880	7 Bearing, 688535
3 Inner Felt Washer, 779503	8 Oil Ring, 49621
4 Outer Dust Cap, 443731A	9 Front Bracket, 688533B
5 Inner Dust Cap, 779502 (Outside Part)	10 Dust Cap, Outer Front, 443745A

**COMPRESSOR MOTOR STARTER**

**FIG. 25**  
**FIG. 25—20 H.P. STARTER**

Item No.	Parts
1	Low Voltage Release Coil (208 V.)
1-A	Low Voltage Release Coil (400 V.)
2	Low Voltage Release without Coil
3	Low Voltage Release Catch
4	Low Voltage Release Hinge Pin.
5	Safety Catch
6	Return Lever
7	Connection Strap, Inner Contacts
8	Return Lever Spring
9	Bearing
10	Operating Shaft, Complete
11	Contact Holder with Shunt and Contact
12	Moving Contact
13	Tank
14	Arc Shield
15	Contact Spring (Double Contact)

Item No.	Parts
16	Contact Spring Rod
17	Contact Spring (Single Contact)
18	Braided Shunt with Terminals
19	Stationary Contact Base with Contacts
20	Stationary Contact
21	Rear Stationary Contact Base with Contacts
22	Bearing
23	Bushing
24	Transformer
25	TA-3 Relay with Panel
26	Overload Relay
27	Latch Spring
28	Latch Arm
29	Latch Push Rod
30	Relay Heaters (208 V.)
30-A	Relay Heaters (400 V.)

## AGITATOR MOTOR

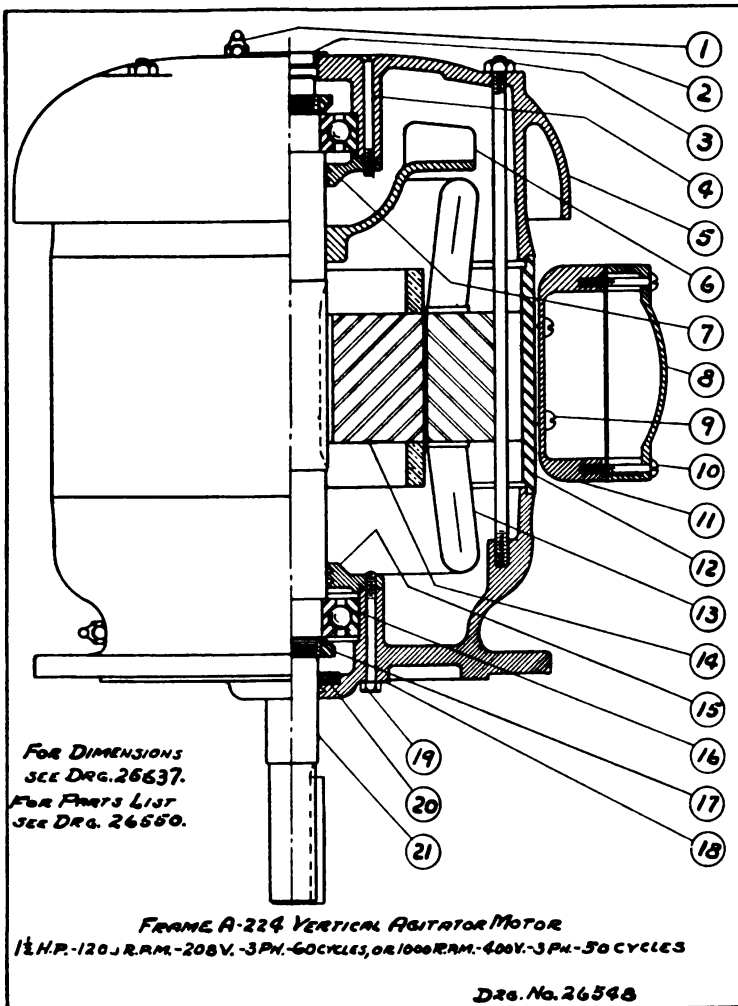


FIG. 26

## Parts

- 1 Alemite Fitting
- 2 Dust Cap
- 3 Through Stud and Nut
- 4 Top Grease Cap Bolt
- 5 Top End Plate
- 6 Fan
- 7 Locking (to) Grease Cap
- 8 Terminal Box Cover
- 9 Terminal Box Screw
- 10 Terminal Box Cover Screw
- 11 Terminal Box
- 12 Stator

## Parts

- 13 Stator Windings
  - 14 Rotor—Less Shaft and Fan
  - 15 Floating (Bottom) Grease Cap
  - 16 Ball Bearing
  - 17 Locknut and Lockwasher
  - 18 Bottom End Plate
  - 19 Bottom Grease Cap Bolt
  - 20 Felt Seal and Retainer
  - 21 Shaft
- Bearing Removal Tool  
Set Inner and Outer Dust Caps

**PART II**

**MAINTENANCE and INSTALLATION**



# MAINTENANCE AND INSTALLATION

## CLEANING PIPE

Before each piece of pipe is put in place, it should be hammered to loosen all scale and blown out with high pressure air. It is well to force a swab through the pipe whenever possible, but when this is done, care must be used to select a cloth that will not leave lint or threads in the pipe.

## MAKING JOINTS

### Welded Joints

When welded joints are used, care must be taken to have the ends of the pipes to be joined cut square, both for the good appearance of a straight finished line and especially so that the two pipe ends will butt squarely together with no appreciable gap between. If the ends of the pipes fit well and reasonable care is exercised by the welder, no loose drippings from the weld will get inside the pipe. The pipe should preferably be cut with a pipe cutter, but a competent welder will find no difficulty in cutting and scarfing a good square end with the cutting torch. If the cuts are made with a torch, the burr of burned iron should be hammered off or cut off with a chisel.

Where welded joints are impossible, as at valve ends, use great care to obtain good threads. If local conditions dictate that these thread joints at valve ends, etc., be made before the adjacent welds, then these welds should be far enough from the thread joints so that the latter will not be affected by the heat of the welds.

### Thread Joints

Thread joints should be cut and made up as follows:

- (a) Ream out the inside of all pipes cut with wheel cutters.
- (b) Cut all threads with good sharp dies, using lard oil only.
- (c) Run a die lightly over all threads which were exposed during shipment.
- (d) All pipe and fitting threads must be thoroughly cleaned. In plants where the fire risk is not great, gasoline may be used, but with every precaution for safety. Otherwise, use carbon tetrachloride or some commercial non-explosive cleaner.
- (e) For ammonia piping, use fresh smooth litharge and glycerine mixed to a thin paste. Use a fresh mixture for each joint or group of joints which will be pulled up simultaneously. Apply the paste to pipe threads of all sizes, and to fitting threads, including 1 inch size and larger. When applying paste to the fitting threads, use only enough to coat the threads lightly, as any excess will be rolled up ahead of the pipe end, and may subsequently break off to exist as loose pieces in the system. When turning a fitting on by hand, turn it back and forth several times to work the litharge well into the interstices of the threads. When the joint has been pulled up, wipe off the excess litharge on the inside whenever possible.
- (f) For water piping, use a recognized commercial pipe joint compound.

### Gasket Joints

Use either lead or fibre gaskets in flange joints and be sure the flanges are square and aligned before the joints are bolted. Bolts must not to be used to spring misaligned flanges. When fibre gaskets are used they should be dipped in oil before they are placed.

Bolts must be drawn up evenly. In drawing up bolts, remember that if flanges are square the joint can be made tight very easily. It is possible with great leverage on a wrench to stretch the bolts to destruction. Care should be exercised to use proper length bolts with sufficient thread to prevent the nut from shouldering before the flanges are tight. During the first few days of operation, flanges should be tightened occasionally until the gaskets are properly set.

## VALVES

All line stop valves and expansion valves are especially constructed for ammonia service. For satisfactory results use only valves recommended for this purpose.

All stop valves should be installed with the valve stems horizontal or as near so as possible, unless a different position is especially required. When the valve stem is horizontal, there is less chance for dirt or scale to lodge on the valve seat or button and cause a leaky valve. When valves leave the Factory, the glands are only hand tight; these must be tightened on the job.

## COMPRESSOR

The preceding discussion of thread and flange joints applies to the piping around the compressor. Joints between the compressor housing and cover plates, bearing heads, and other parts are scraped smooth and true. Fibre gaskets,  $\frac{1}{32}$  inch thick, coated with oil and graphite ("Oildag") are used in these joints because such joints need be opened occasionally.

The suction line piping to the compressor should contain no unnecessary traps in which oil or liquid may accumulate and periodically be drawn into the compressor. Slugs of liquid to the compressor will reduce the efficiency of the compressor, and may be conducive to oil pumping and failure of the moving parts of the compressor through breakage or excessive wear.

## CONDENSERS AND EVAPORATORS

All shells and coils, both condensers and evaporators, have all openings either plugged, capped, or blank flanged, depending on the type of opening. Do not remove these plugs, caps, or flanges until ready to connect the piping. Use every precaution to keep moisture or dirt out of the equipment.

## AIR PRESSURE TEST

- (a) Remove the flange from the bottom of the suction strainer body, clean the inside of the strainer body, close suction valve (B), and open discharge valve (A).
- (b) Close all valves that open to the atmosphere and open all remaining valves within the system.
- (c) Start the compressor, run plenty of water through the jacket, pump 140 pounds pressure in the entire system, stop the compressor, and close valve (A). When pumping an air pressure with an ammonia compressor, do not allow the cylinders to become hot. It will be necessary to pump the test pressure in several periods and allow the cylinders to cool off between periods.
- (d) Carefully examine all thread, flange, and welded joints and valve stuffing boxes for leaks, using soap suds freely. Very small leaks that require one or two minutes to show bubbles are not to be passed. A few drops of glycerine in the water will make the lather last longer.

When the entire system is found to be tight at 140 pounds pressure, continue as follows:

- (e) Separate the condensing side from the evaporating side by closing valve (O) (Page 11).
- (f) Blow the air from the evaporator out through the suction strainer. To do this, plug the opening leading from the strainer body to the compressor cylinder with a large cloth, and open valve (B) wide. The suction valve (B) must be opened wide so that the velocity of the air will carry along any dirt or scale that may have worked loose from the pipes and fittings. After this is done, be sure to remove the cloth from the opening between the strainer and compressor.

- (g) **CAUTION:** The relief valve built into the compressor is set to release when the discharge pressure is 250 pounds higher than the suction pressure. For this reason it is necessary, before testing the high side at the compressor to higher than 240 pounds, to remove the relief valve cartridge and screw in its place a blank pipe plug made of a short nipple with one end welded shut. After the tests for leaks are completed, be sure to remove the blank pipe plug and screw in the compressor relief valve.
- (h) Start the compressor and pump 240 pounds air pressure in the condensing side. **CAUTION:** Pump the 240 pounds pressure in very easy stages so as not to over-heat the compressor cylinders. Do not pump a pressure higher than 240 pounds, as the relief valves are set to pop at 250 pounds. After relief valves have once popped they are apt to leak slightly unless they are taken apart and cleaned thoroughly.
- (i) Again carefully examine all ammonia piping on the condensing side for leaks as outlined under (d). To release the air from the condensing side, blow down through the oil drain valve "D" to remove any remaining water which might have condensed from the air which was pumped into the system, and also to remove any dirt or scale that may have worked loose from the pipe or fittings.

## TO EVACUATE THE SYSTEM

Before charging the system with ammonia, it is first necessary to pump as great a vacuum in the entire system as possible, both to remove all air and to evaporate and expel any remaining moisture. To do this, proceed as follows:

- (a) Close valve "A."
  - (b) Open valve "B" and see that all remaining valves in the system are open and all valves that open to the atmosphere are closed.
  - (c) Open valve "C" in the compressor manifold.
  - (d) Start compressor and pump the greatest vacuum possible.
  - (e) Stop the compressor and, as soon as the flywheel comes to rest, close valve "C."
- If the system will maintain a vacuum over night without loss, the plant is ready for charging with ammonia.

## HANDLING AMMONIA

Ammonia gas is poisonous if inhaled in large quantities, and in lesser quantities is irritating to the eyes, nose, and throat. Also liquid ammonia when splashed in the eyes is especially injurious. Therefore great care must be taken when servicing systems or when opening parts of a system in which ammonia is confined. If necessary to go in a room where the concentration of ammonia in the atmosphere is high, or if necessary to open equipment in which ammonia is confined, a gas mask specially designed for ammonia must be worn. Yorkco gas masks, with instructions attached, are available in the Branches and at the Factory.

## FIRST AID TREATMENT

If liquid ammonia comes in contact with the skin, strip the ammonia saturated clothing from the body. Wash with water and then paint the burned surfaces with a saturater aqueous solution of Picric Acid; if near the eyes, use Boric Acid solution.

If liquid ammonia comes in contact with the eyes, the person suffering the injury should be taken at once to an eye specialist. Avoid rubbing or irritating the eyes and give the following first aid treatment immediately:

*First*—Wash the eyes with clean water.

*Second*—Drops of two percent (2%) Boric Acid solution should be introduced into the eyes as an irrigant. Wash thoroughly in this way for five minutes, then allow two drops of liquid petrolatum to fall on the eyeball.

For throat or nose irritation, snuff Boric Acid solution up the nose and rinse out the mouth thoroughly. Encourage the injured to drink large amounts of water.

If a person is overcome by ammonia fumes, immediately move the person to the open air, and get a physician. The patient should be kept warm and quiet. As an antidote have the patient drink one-half glassful of equal parts of vinegar and olive oil.

Ammonia gas is lighter than air and therefore rises. In case of accident, keep your head as low as possible and place a wet sponge or cloth over the mouth and nostrils. Water will absorb the gas and prevent its inhalation.

The First Aid Kit should contain the following:

2% Boric Acid

Saturated aqueous solution of Picric Acid

Sealed package absorbent cotton

Liquid petrolatum and medicine dropper.

## CHARGING AMMONIA

To charge the system with the initial charge of ammonia, proceed as follows:

- (a) Connect the ammonia drum to the charging valve with the drum in the position as called for in the manufacturer's instructions. See that the stuffing box on the ammonia drum valve is tight. NOTE: Most of these valves have left-hand stuffing box threads.
- (b) Open the ammonia drum valve slightly. If the charging connections are all tight, open the charging valve "R" wide and regulate the flow of ammonia into the system by means of the ammonia drum valve until the pressure in the entire system reaches about 5 pounds. Then go over the piping, and if there are no leaks, charge in ammonia until the pressure over the entire system builds up to about 20 pounds.
- (c) When all the liquid has been expelled from a shipping drum, the drum will become cold around the valve. Generally, if the system is large enough to require several drums of ammonia, it will pay to open the drum valve wide to quickly dump the liquid into the system. Then a more definite indication that all the liquid has been expelled from the drum, will be the loud hissing sound which occurs when gas starts to pass through the drum valve. This hissing sound is very distinct and unmistakable to anyone paying casual attention to the charging operation. The sound lasts for several seconds until the gas pressure in the drum is equalized with the pressure in the system. When empty, close the drum valve, and replace the drum with a full one if more ammonia is required. Each drum should be weighed after it is disconnected and the weight, including the valve guard, compared with the tare weight which is marked on the drum tag. A record can be kept of the actual amount of ammonia charged.
- (d) When enough ammonia has been charged to produce a pressure of 20 pounds in the entire system, close the condenser liquid outlet valve "O," and start the compressor as explained for normal operation in the compressor instructions. Operate the compressor to maintain 10 to 20 pounds suction pressure, and continue charging until enough ammonia has been added to produce a pressure of about 75 pounds per square inch throughout the system. To equalize the pressure throughout the system, stop the compressor and open the liquid outlet valves "O," "S," and "U" between the condenser and the evaporator.
- (e) With the system equalized at about 75 pounds pressure, carefully examine all joints for leaks as explained under TESTING FOR AMMONIA LEAKS, pages 44-49.
- (f) When satisfied that there are no ammonia leaks in the entire system at about 75 pounds pressure, close the condenser liquid outlet valve "O," start the compressor as for normal operation, and proceed with the charging operation.

The following considerations are of importance: In general, the lower the suction pressure can be maintained during charging, the less ammonia will be left in the shipping drums; some systems, especially those with flooded evaporators, may not have sufficient storage capacity in the condensing side to hold all the liquid during the final stages of the charging operation. As the amount of ammonia in the system approaches normal charge, it is generally advisable to put the plant in normal operation and add the remainder of the ammonia at the prevailing suction pressure, checking the charge frequently as outlined under CHECKING AMMONIA CHARGE. An idea of the total amount required for normal charge is afforded by the amount of ammonia furnished for the job.

### CHECKING AMMONIA CHARGE

A refrigerating system should have a full charge of refrigerant at all times; otherwise, the efficiency and capacity of the system will be impaired and the power cost proportionately high.

The condenser is kept constantly drained by means of a high pressure float ammonia regulator, and it is necessary to adjust the charge of ammonia to the exact amount required when the compressor is operating under normal full load condition, the charge can generally be adjusted to obtain 4 to 10 degrees superheat at the compressor.

It is important to adjust the refrigerant charge in the system so that the compressor will not pump liquid. Liquid pumping will reduce the efficiency of the compressor, and may be conducive to oil pumping and failure of the moving parts through breakage or excessive wear. It may be difficult to determine by the temperature of the suction gas when the compressor is pumping liquid. When this condition exists, the compressor discharge gas temperature can be used to determine whether the compressor is operating with wet (pumping liquid) or dry compression.

<i>Condenser Pressures and Corresponding Temperatures</i>	<i>Discharge Temperatures for Various Operating Pressures Ammonia Compression</i>														
	<i>Suction Gage Pressure and Corresponding Temperatures</i>														
	0°G. -28°F.	2.5°G. -22.3°F.	5°G. -17.2°F.	7.5°G. -12.6°F.	10°G. -8.4°F.	12.5°G. -4.55°F.	15.7°G. 0°F.	17.5°G. 2.35°F.	20°G. 5.5°F.	22.5°G. 8.5°F.	25°G. 11.3°F.	27.5°G. 14.0°F.	30°G. 16.6°F.	35°G. 21.4°F.	40°G. 25.8°F.
105°G. 65.9°F.	240	225	210	200	189	183	172	167	160	154	149	142	138	131	123
115°G. 70.4°F.	253	238	223	213	202	195	184	179	172	165	160	154	149	141	134
125°G. 74.65°F.	265	251	235	225	214	206	195	190	183	176	171	165	160	151	144
135°G. 78.7°F.	277	262	246	236	225	217	205	200	193	186	181	175	170	161	154
145°G. 82.55°F.	288	273	256	246	235	227	214	210	203	196	191	184	180	170	163
155°G. 86.15°F.	298	283	266	256	244	237	224	219	212	205	200	193	189	179	171
165°G. 89.65°F.	308	293	276	266	254	246	233	228	221	214	209	202	198	188	179
175°G. 93.05°F.	318	303	286	275	263	255	242	237	230	222	217	210	206	196	187
185°G. 96.25°F.	328	312	295	284	272	264	251	246	238	230	225	218	214	204	195
195°G. 99.35°F.	336	321	304	292	280	272	259	254	246	238	233	226	221	212	203
205°G. 102.3°F.	345	329	312	300	288	280	267	261	254	246	241	234	228	219	210
215°G. 105.2°F.	354	337	320	308	295	288	274	269	261	254	248	241	235	226	217
225°G. 108.0°F.	361	345	328	316	303	295	281	276	268	261	255	247	242	233	224

TABLE 1

Table 1 shows the theoretical (adiabatic) temperature of the discharge gas from the compressor at various suction pressures with saturation at the compressor (zero suction

gas superheat). This table can be used to determine whether the compressor is operated with wet (pumping liquid) or dry compression. To apply the data given in Table 1, proceed as follows:

**IMPORTANT:** For satisfactory results, it is necessary that the condenser be purged of non-condensable gases and that the compressor suction and discharge valves be reasonably tight.

- (a) Read the actual temperature of the discharge gas leaving the compressor.
- (b) Observe the suction and discharge pressure at which the compressor is operating and from Table 1 read the theoretical discharge temperature for the corresponding pressures.
- (c) If the actual temperature of the discharge gas leaving the compressor is below the theoretical temperature found in Table 1, the compressor is operating with wet, or partially wet, compression and may be pumping liquid. With a high pressure float regulator, this may be attributed to the system being over charged; too much liquid is being fed to the evaporator.
- (d) If the actual temperature of the discharge gas leaving the compressor is higher than the theoretical temperature found in Table 1, the compressor is operating with dry compression.

## TESTING FOR AMMONIA LEAKS

Immediately after or during the process of charging, the system should be carefully inspected for leaks. As ammonia has a disagreeable and pungent odor, a small leak is readily noticed, but its location is not so easily found. An ammonia gas mask should be available and in good repair for use in case of an emergency.

## USE OF RE-AGENTS

Detector re-agents, such as sulphur taper, sensitive paper, caustic soda, and Nessler's solution are satisfactory to detect ammonia leaks. The suitability of the various re-agents to test for ammonia leaks depends upon the conditions under which the leak may occur.

Sulphur taper is suitable for testing for an ammonia leak when the leak is escaping into the atmosphere. When a sulphur taper is used for testing, the sulphur coating should be lighted and moved at a distance of about one inch around all threaded joints, flanges, fittings, valve bonnets, and stuffing box packing. A cloud of white smoke from the sulphur indicates an ammonia leak is near by. If the test is being made in a room while ammonia fumes are present in the atmosphere, the origin of the leak may be indicated by a greater density of the smoke from the sulphur.

Sensitive, or phenolphthalein, paper is frequently but erroneously referred to as "litmus" paper. Sensitive paper may be used for locating a leak in an exposed coil by simply dampening the paper and running it along the coil. Upon coming in contact with ammonia, the paper will turn a deep red color. To locate a leak in submerged coils, dip the paper in a glass of water taken from the tank surrounding the coils, and if ammonia is present the paper will turn red.

Sensitive paper cannot be dependably used in brine, as it is entirely possible that the brine itself has an alkaline reaction, which would turn the paper red whether ammonia is present or not.

The caustic soda test for determining the presence of ammonia in brine is quite easily made and is reliable. An ordinary glass or cup is filled about one-half full of the brine to be tested. A small amount of caustic soda, preferably granulated, is added to the brine. Time must be given for the caustic soda to dissolve and to thoroughly mix with the brine (if a white precipitate forms, it will do no harm). The glass or cup is then covered with a small piece of window glass to the underside of which a small piece of sensitive paper is attached by moistening with water. The test paper must be white

**PROPERTIES OF SATURATED AMMONIA VAPOR**  
**Gauge Pressure Table**  
**U. S. Bureau of Standards**

Pressure. (gauge). lbs./in. <sup>2</sup> <i>P.</i>	Temp. °F. <i>t</i>	Volume vapor. ft. <sup>3</sup> /lb. <i>v</i>	Density vapor lbs./ft. <sup>3</sup> <i>1/v</i>	Heat Content		Latent heat. Btu./lb. <i>L</i>	Entropy			Pressure (gauge). lbs./in. <sup>2</sup> <i>P.</i>
				Liquid. Btu./lb. <i>A</i>	Vapor. Btu./lb. <i>H</i>		Liquid. Btu./lb.°F. <i>f</i>	Evap. Btu./lb.°F. <i>L/T</i>	Vapor. Btu./lb.°F. <i>g</i>	
20*	63.9	50.5	0.0198	-25.3	588.0	613.3	0.062	1.550	1.488	20*
19*	61.0	46.2	0.0217	-22.3	589.2	611.5	0.055	.535	.480	19*
18*	58.4	42.6	0.0235	-19.5	590.3	609.8	0.048	.521	.473	18*
17*	55.9	39.5	0.0253	-16.9	591.3	608.2	0.041	.507	.466	17*
16*	53.6	36.8	0.0272	-14.5	592.2	606.7	0.035	.495	.460	16*
15*	51.4	34.5	0.0290	-12.2	593.1	605.3	0.029	1.483	1.454	15*
14*	49.4	32.5	0.0308	-10.0	593.9	603.9	0.023	.472	.449	14*
13*	47.4	30.7	0.0326	-7.9	594.7	602.6	0.019	.462	.443	13*
12*	45.6	29.1	0.0344	-5.9	595.4	601.3	0.014	.452	.438	12*
11*	43.8	27.6	0.0362	-4.0	596.1	600.1	0.010	.443	.433	11*
10*	42.1	26.3	0.0380	-2.2	596.8	599.0	0.005	1.434	1.429	10*
9*	40.4	25.2	0.0397	-0.5	597.4	597.9	0.001	.426	.425	9*
8*	38.9	24.1	0.0415	+ 1.2	598.0	596.8	0.003	.418	.421	8*
7*	37.3	23.1	0.0433	2.8	598.6	595.8	0.007	.411	.418	7*
6*	35.9	22.2	0.0450	4.4	599.1	594.7	0.010	.405	.415	6*
5*	34.5	21.4	0.0468	5.9	599.6	593.7	0.014	1.397	1.411	5*
4*	33.1	20.6	0.0485	7.4	600.2	592.8	0.017	.390	.407	4*
3*	31.8	19.9	0.0503	8.8	600.7	591.9	0.020	.384	.404	3*
2*	30.5	19.2	0.0520	10.2	601.2	591.0	0.024	.377	.401	2*
1*	29.2	18.6	0.0538	11.5	601.6	590.1	0.027	.371	.398	1*
0	28.0	18.0	0.0555	12.8	602.1	589.3	0.030	1.366	1.396	0
1	25.6	16.9	0.0590	15.4	603.0	587.6	0.036	.354	.390	1
2	23.4	16.0	0.0626	17.8	603.8	586.0	0.041	.344	.385	2
3	21.2	15.1	0.0661	20.1	604.6	584.5	0.047	.333	.380	3
4	19.2	14.4	0.0695	22.3	605.3	583.0	0.052	.324	.376	4
5	17.2	13.7	0.0730	24.4	606.0	581.6	0.056	1.315	1.371	5
6	15.3	13.1	0.0765	26.4	606.6	580.2	0.061	.306	.367	6
7	13.5	12.5	0.0799	28.4	607.3	578.9	0.065	.298	.363	7
8	11.8	12.0	0.0834	30.3	607.9	577.6	0.070	.290	.360	8
9	10.1	11.5	0.0868	32.1	608.4	576.3	0.074	.282	.356	9
10	8.4	11.1	0.0902	33.8	609.0	575.2	0.078	1.275	1.353	10
11	6.9	10.7	0.0937	35.5	609.5	574.0	0.081	.268	.349	11
12	5.3	10.3	0.0971	37.1	610.0	572.9	0.085	.261	.346	12
13	3.8	9.96	.100	38.8	610.5	571.7	0.088	.255	.343	13
14	2.4	9.63	.104	40.4	611.0	570.6	0.092	.248	.340	14
15	1.0	9.32	0.107	41.9	611.4	569.5	0.095	1.242	1.337	15
16	+ 0.4	9.04	.111	43.4	611.9	568.5	0.098	.236	.334	16
17	1.7	8.78	.114	44.8	612.3	567.5	0.101	.230	.331	17
18	3.0	8.53	.117	46.2	612.7	566.5	0.104	.225	.329	18
19	4.3	8.28	.121	47.6	613.1	565.5	0.107	.219	.326	19
20	5.5	8.06	0.124	48.9	613.5	564.6	0.110	1.214	1.324	20
21	6.7	7.85	.127	50.2	613.9	563.7	0.113	.209	.322	21
22	7.9	7.65	.131	51.5	614.2	562.7	0.116	.204	.320	22
23	9.1	7.46	.134	52.8	614.6	561.8	0.119	.199	.318	23
24	10.2	7.28	.138	54.0	614.9	560.9	0.121	.194	.315	24
25	11.3	7.11	0.141	55.3	615.3	560.0	0.124	1.189	1.313	25
26	12.4	6.94	.144	56.5	615.6	559.1	0.126	.185	.311	26
27	13.5	6.78	.148	57.6	615.9	558.3	0.129	.180	.309	27
28	14.5	6.63	.151	58.8	616.2	557.4	0.131	.176	.307	28
29	15.6	6.49	.154	59.9	616.5	556.6	0.134	.171	.305	29
30	16.6	6.35	0.158	61.0	616.8	555.8	0.136	1.167	1.303	30

\*Inches of mercury below one standard atmosphere (29.92 in.).

TABLE 2

**PROPERTIES OF SATURATED AMMONIA VAPOR**  
**Gage Pressure Table**  
**U. S. Bureau of Standards**

Pressure. (gage). lbs./in. <sup>2</sup> <i>p.</i>	Temp. °F. <i>t</i>	Volume vapor. ft. <sup>3</sup> /lb. <i>v</i>	Density vapor lbs./ft. <sup>3</sup> <i>1/v</i>	Heat Content		Latent heat. Btu./lb. <i>L</i>	Entropy			Pressure (gage). lbs./in. <sup>2</sup> <i>p.</i>
				Liquid. Btu./lb. <i>h</i>	Vapor. Btu./lb. <i>H</i>		Liquid. Btu./lb.°F. <i>f</i>	Evap. Btu./lb.°F. <i>L/T</i>	Vapor. Btu./lb.°F. <i>s</i>	
30	16.6	6.35	0.158	61.0	616.8	555.8	0.136	1.167	1.303	30
31	17.6	6.22	.161	62.1	617.1	555.0	.138	.163	.301	31
32	18.6	6.09	.164	63.2	617.4	554.2	.140	.159	.299	32
33	19.5	5.97	.168	64.2	617.6	553.4	.143	.155	.298	33
34	20.5	5.85	.171	65.3	617.9	552.6	.145	.151	.296	34
35	21.4	5.74	0.174	66.3	618.2	551.9	0.147	1.148	1.295	35
36	22.3	5.64	.177	67.3	618.4	551.1	.149	.144	.293	36
37	23.2	5.54	.181	68.3	618.7	550.4	.151	.140	.291	37
38	24.1	5.44	.184	69.2	618.9	549.7	.153	.137	.290	38
39	25.0	5.34	.187	70.2	619.1	548.9	.155	.133	.288	39
40	25.8	5.25	0.191	71.2	619.4	548.2	0.157	1.130	1.287	40
41	26.7	5.16	.194	72.1	619.6	547.5	.159	.126	.285	41
42	27.5	5.07	.197	73.0	619.8	546.8	.161	.123	.284	42
43	28.3	4.99	.201	73.9	620.0	546.1	.163	.119	.282	43
44	29.2	4.91	.204	74.8	620.3	545.5	.164	.116	.280	44
45	30.0	4.83	0.207	75.7	620.5	544.8	0.166	1.113	1.279	45
46	30.8	4.76	.210	76.6	620.7	544.1	.168	.110	.278	46
47	31.5	4.68	.214	77.4	620.9	543.5	.170	.107	.277	47
48	32.3	4.61	.217	78.3	621.1	542.8	.171	.104	.275	48
49	33.1	4.54	.220	79.1	621.3	542.2	.173	.101	.274	49
50	33.8	4.48	0.224	80.0	621.5	541.5	0.175	1.098	1.273	50
51	34.6	4.41	.227	80.8	621.7	540.9	.177	.095	.272	51
52	35.3	4.35	.230	81.6	621.8	540.2	.178	.092	.270	52
53	36.1	4.29	.233	82.4	622.0	539.6	.180	.089	.269	53
54	36.8	4.23	.237	83.2	622.2	539.0	.181	.086	.267	54
55	37.5	4.17	0.240	84.0	622.4	538.4	0.183	1.083	1.266	55
56	38.2	4.12	.243	84.8	622.5	537.7	.185	.080	.265	56
57	38.9	4.06	.246	85.6	622.7	537.1	.186	.078	.264	57
58	39.6	4.01	.250	86.3	622.9	536.6	.188	.075	.263	58
59	40.3	3.96	.253	87.0	623.0	536.0	.189	.072	.261	59
60	40.9	3.91	0.256	87.8	623.2	535.4	0.191	1.069	1.260	60
61	41.6	3.86	.260	88.6	623.4	534.8	.192	.067	.259	61
62	42.3	3.81	.263	89.3	623.5	534.2	.194	.064	.258	62
63	42.9	3.77	.266	90.0	623.7	533.7	.195	.062	.257	63
64	43.6	3.72	.269	90.7	623.8	533.1	.196	.060	.256	64
65	44.2	3.67	0.273	91.5	624.0	532.5	0.198	1.057	1.255	65
66	44.8	3.63	.276	92.2	624.1	531.9	.199	.055	.254	66
67	45.5	3.59	.279	92.9	624.2	531.3	.201	.052	.253	67
68	46.1	3.55	.282	93.6	624.4	530.8	.202	.050	.252	68
69	46.7	3.51	.286	94.3	624.5	530.2	.203	.048	.251	69
70	47.3	3.47	0.289	94.9	624.6	529.7	0.205	1.045	1.250	70
71	47.9	3.43	.292	95.6	624.8	529.2	.206	.043	.249	71
72	48.5	3.39	.295	96.3	624.9	528.6	.207	.041	.248	72
73	49.1	3.35	.299	97.0	625.1	528.1	.209	.038	.247	73
74	49.7	3.32	.302	97.6	625.2	527.6	.210	.036	.246	74
75	50.3	3.28	0.305	98.3	625.3	527.0	0.211	1.034	1.245	75
76	50.9	3.24	.308	98.9	625.4	526.5	.212	.032	.244	76
77	51.5	3.21	.312	99.5	625.5	526.0	.214	.029	.243	77
78	52.0	3.17	.315	100.2	625.7	525.5	.215	.027	.242	78
79	52.6	3.14	.318	100.8	625.8	525.0	.216	.025	.241	79
80	53.1	3.11	0.322	101.5	625.9	524.4	0.217	1.023	1.240	80

TABLE 2

**PROPERTIES OF SATURATED AMMONIA VAPOR**  
**Gage Pressure Table**  
**U. S. Bureau of Standards**

Pressure. (gage). lbs./in. <sup>2</sup> <i>P</i>	Temp. °F. <i>t</i>	Volume vapor. ft. <sup>3</sup> /lb. <i>v</i>	Density vapor lbs./ft. <sup>3</sup> <i>1/v</i>	Heat Content		Latent heat. Btu./lb. <i>L</i>	Entropy			Pressure (gage). lbs./in. <sup>2</sup> <i>P</i>
				Liquid. Btu./lb. <i>h</i>	Vapor. Btu./lb. <i>H</i>		Liquid. Btu./lb.°F. <i>J</i>	Evap. Btu./lb.°F. <i>L/T</i>	Vapor. Btu./lb.°F. <i>S</i>	
80	53.1	3.11	0.322	101.5	625.9	524.4	0.217	1.023	1.240	80
81	53.7	3.08	.325	102.1	626.0	523.9	.219	.020	.239	81
82	54.3	3.05	.328	102.7	626.1	523.4	.220	.018	.238	82
83	54.8	3.02	.331	103.3	626.3	523.0	.221	.016	.237	83
84	55.3	2.99	.335	103.9	626.4	522.5	.222	.015	.237	84
85	55.9	2.96	0.338	104.5	626.5	522.0	0.223	1.013	1.236	85
86	56.4	2.94	.341	105.1	626.6	521.5	.224	.011	.235	86
87	57.0	2.91	.344	105.7	626.7	521.0	.226	.008	.234	87
88	57.5	2.88	.348	106.3	626.8	520.5	.227	.006	.233	88
89	58.0	2.85	.351	106.9	626.9	520.0	.228	.005	.233	89
90	58.5	2.82	0.354	107.5	627.0	519.5	0.229	1.003	1.232	90
91	59.0	2.80	.357	108.1	627.1	519.0	.230	.001	.231	91
92	59.6	2.77	.361	108.7	627.2	518.5	.231	0.999	.230	92
93	60.1	2.75	.364	109.3	627.3	518.0	.232	.997	.229	93
94	60.6	2.72	.367	109.8	627.4	517.6	.233	.995	.228	94
95	61.1	2.70	0.370	110.4	627.5	517.1	0.235	0.993	1.228	95
96	61.6	2.68	.374	111.0	627.6	516.6	.236	.991	.227	96
97	62.0	2.65	.377	111.6	627.7	516.1	.237	.989	.226	97
98	62.5	2.63	.380	112.1	627.8	515.7	.238	.988	.226	98
99	63.0	2.61	.383	112.6	627.9	515.3	.239	.986	.225	99
100	63.5	2.59	0.287	113.2	628.0	514.8	0.240	0.984	1.224	100
102	64.5	2.54	.393	114.2	628.1	513.9	.242	.981	.223	102
104	65.4	2.50	.400	115.3	628.3	513.0	.244	.977	.221	104
106	66.4	2.46	.406	116.4	628.5	512.1	.246	.974	.220	106
108	67.3	2.42	.413	117.4	628.6	511.2	.248	.970	.218	108
110	68.2	2.39	0.419	118.5	628.8	510.3	0.250	0.967	1.217	110
112	69.1	2.35	.426	119.5	628.9	509.4	.252	.964	.216	112
114	70.0	2.31	.432	120.5	629.1	508.6	.254	.960	.214	114
116	70.8	2.28	.439	121.5	629.3	507.8	.256	.957	.213	116
118	71.7	2.25	.445	122.5	629.4	506.9	.257	.954	.211	118
120	72.6	2.21	0.452	123.5	629.5	506.0	0.259	0.951	1.210	120
122	73.4	2.18	.458	124.5	629.7	505.2	.261	.948	.209	122
124	74.2	2.15	.465	125.4	629.8	504.4	.263	.945	.208	124
126	75.1	2.12	.471	126.3	629.9	503.6	.264	.942	.206	126
128	75.9	2.09	.478	127.3	630.1	502.8	.266	.939	.205	128
130	76.7	2.06	0.484	128.2	630.2	502.0	0.268	0.936	1.204	130
132	77.5	2.04	.491	129.1	630.3	501.2	.270	.933	.203	132
134	78.3	2.01	.497	130.0	630.4	500.4	.271	.930	.201	134
136	79.1	1.98	.504	130.9	630.5	499.6	.273	.927	.200	136
138	79.9	1.96	.510	131.8	630.7	498.9	.274	.925	.199	138
140	80.6	1.93	0.517	132.7	630.8	498.1	0.276	0.922	1.198	140
142	81.4	1.91	.523	133.6	630.9	497.3	.278	.919	.197	142
144	82.2	1.89	.530	134.5	631.0	496.5	.279	.917	.196	144
146	82.9	1.86	.536	135.3	631.1	495.8	.281	.914	.195	146
148	83.6	1.84	.543	136.2	631.2	495.0	.283	.911	.194	148
150	84.4	1.82	0.550	137.0	631.3	494.3	0.284	0.909	1.193	150

TABLE 2

PROPERTIES OF SATURATED AMMONIA VAPOR  
Gage Pressure Table  
U. S. Bureau of Standards

Pressure, (gage), lbs./in. <sup>2</sup> <i>P</i>	Temp. °F. <i>t</i>	Volume vapor, ft. <sup>3</sup> /lb. <i>V</i>	Density vapor lbs./ft. <sup>3</sup> <i>1/V</i>	Heat Content		Latent heat, Btu./lb. <i>L</i>	Entropy			Pressure (gage), lbs./in. <sup>2</sup> <i>P</i>
				Liquid, Btu./lb. <i>h</i>	Vapor, Btu./lb. <i>H</i>		Liquid, Btu./lb.°F. <i>f</i>	Evap., Btu./lb.°F. <i>L/T</i>	Vapor, Btu./lb.°F. <i>g</i>	
150	84.4	1.82	0.550	137.0	631.3	494.3	0.284	0.909	1.193	150
152	85.1	1.80	.556	137.9	631.4	493.5	.286	.906	.192	152
154	85.8	1.78	.563	138.7	631.5	492.8	.287	.904	.191	154
156	86.5	1.76	.569	139.5	631.6	492.1	.289	.901	.190	156
158	87.2	1.74	.576	140.3	631.7	491.4	.290	.899	.189	158
160	88.0	1.72	0.582	141.1	631.8	490.7	0.292	0.896	1.188	160
162	88.6	1.70	.589	141.9	631.9	490.0	.293	.894	.187	162
164	89.3	1.68	.595	142.7	631.9	489.2	.294	.891	.185	164
166	90.0	1.66	.602	143.5	632.0	488.5	.296	.889	.185	166
168	90.7	1.64	.609	144.3	632.1	487.8	.297	.886	.183	168
170	91.4	1.62	0.615	145.1	632.1	487.0	0.299	0.884	1.183	170
172	92.0	1.61	.622	145.8	632.2	486.4	.300	.882	.182	172
174	92.7	1.59	.628	146.6	632.3	485.7	.302	.879	.181	174
176	93.4	1.57	.635	147.4	632.4	485.0	.303	.877	.180	176
178	94.0	1.56	.641	148.2	632.5	484.3	.304	.875	.179	178
180	94.7	1.54	0.648	148.9	632.5	483.6	0.305	0.873	1.178	180
182	95.3	1.53	.655	149.7	632.6	482.9	.307	.870	.177	182
184	95.9	1.51	.661	150.5	632.7	482.2	.308	.868	.176	184
186	96.6	1.50	.668	151.2	632.7	481.5	.309	.866	.175	186
188	97.2	1.48	.674	151.9	632.8	480.9	.311	.863	.174	188
190	97.8	1.47	0.681	152.6	632.8	480.2	0.312	0.861	1.173	190
192	98.4	1.45	.688	153.4	632.9	479.5	.314	.859	.173	192
194	99.0	1.44	.694	154.0	632.9	478.9	.315	.857	.172	194
196	99.7	1.43	.701	154.8	633.0	478.2	.316	.855	.171	196
198	100.3	1.41	.708	155.5	633.0	477.5	.317	.853	.170	198
200	100.9	1.40	0.714	156.2	633.1	476.9	0.318	0.851	1.169	200
205	102.3	1.37	.731	158.0	633.2	475.2	.321	.846	.167	205
210	103.8	1.34	.747	159.6	633.3	473.7	.324	.841	.165	210
215	105.2	1.31	.764	161.3	633.4	472.1	.327	.836	.163	215
220	106.6	1.28	.781	163.0	633.5	470.5	.330	.831	.161	220
225	108.0	1.25	0.797	164.6	633.6	469.0	0.333	0.826	1.159	225
230	109.4	1.23	.814	166.3	633.7	467.4	.336	.822	.158	230
235	110.7	1.20	.831	167.9	633.8	465.9	.339	.817	.156	235
240	112.0	1.18	.848	169.4	633.8	464.4	.341	.813	.154	240
245	113.3	1.16	.864	171.0	633.9	462.9	.344	.808	.152	245
250	114.6	1.13	0.881	172.6	633.9	461.3	0.346	0.804	1.150	250
255	115.9	1.11	.898	174.1	634.0	459.9	.349	.799	.148	255
260	117.1	1.09	.915	175.6	634.0	458.4	.352	.795	.147	260
265	118.4	1.07	.932	177.0	634.0	457.0	.354	.791	.145	265
270	119.6	1.05	.949	178.5	634.0	455.5	.357	.786	.143	270
275	120.8	1.03	0.966	179.9	634.0	454.1	0.359	0.783	1.142	275
280	122.0	1.02	.983	181.4	634.0	452.6	.362	.778	.140	280
285	123.1	1.00	1.000	182.8	634.0	451.2	.364	.774	.138	285
290	124.3	0.98	1.018	184.2	634.0	449.8	.367	.770	.137	290
295	125.4	0.97	1.035	185.6	634.0	448.4	.369	.766	.135	295
300	126.5	0.95	1.052	187.0	634.0	446.9	0.371	0.762	1.133	300

TABLE 2

when the piece of window glass is placed over the brine and the paper must not come in contact with the brine and caustic soda mixture. If the brine contains ammonia, the test paper will be turned red by the vapor. If the glass is placed in warm water, the reaction is hastened. It is necessary to do the testing in a room which is free of ammonia. For very small quantities of ammonia, the reaction takes a little time. If the paper remains unaffected after five minutes, it can be concluded that the brine is free of ammonia.

Nessler's solution may be used to test for ammonia leaks when the ammonia coil is submerged in brine. Sodium chloride brine can be tested for ammonia without preliminary treatment. To test with Nessler's solution, obtain in a glass vessel a small sample of the brine from the apparatus during normal operation, dilute with four parts water, filter the sample until it is clear, and then add a few drops of Nessler's solution. If the color of the sample changes to yellow, a small leak is present; if dark brown, the leak is more serious.

## USE OF SOAP SUDS

To prepare soap suds for testing, use a soap and water solution of about the consistency of liquid hand soap, which will lather freely, or work up a lather on the brush by rubbing the wetted brush on a cake of soap. A few drops of glycerine added to the solution will cause the lather to remain wet longer. When applying the soap suds, paint the soap lather all the way around and examine the joint thoroughly for bubbles. When the joint is located so that a part of it is not visible, use a pocket mirror. It will sometimes take a full minute or more for bubbles to appear at a small leak. Questionable spots should be covered with lather and examined again.

## PURGING CONDENSERS

In the condenser instructions is outlined a method of determining the presence of non-condensable gases and purging them from the system.

## FREEZING TANK INSTALLATION

It is very important that the tank foundation be put on solid ground, for should the tank settle it would be impossible to carry the proper brine level when the plant is in operation. A little extra time and consideration spent in preparing the tank foundation is certainly justified.

We have outlined below a method for building a foundation. However, the customer is entirely responsible for its construction, and should secure expert advice when in doubt as to the firmness of the soil on which the foundation is to be placed, and as to the correct foundation required for the bearing weight specified.

If the ground on which the tank foundation is to be placed is firm, an excellent footing can be made by filling in about 4 to 6 inches of cinders and packing them down thoroughly. Considerable time and expense may be saved by preparing the tank foundation bed during the early stages of building construction, at which time it may be possible to dump the cinders right in place and pack them down by running a loaded truck back and forth over the cinder fill. When a tank is to be installed on soft or filled ground, it will be necessary to use reinforcing iron in the concrete foundation, and may even be necessary to drive pilings.

After the tank foundation bed has been properly graded and packed, the foundation curbing can be placed and the elevation stakes driven. The entire foundation bed should then be staked off in lots, and all stakes driven so as to come flush with the top of the finished foundation. A convenient way to stake off the foundation bed is as follows:

- (a) Drive a row of stakes across the high end of the foundation bed so that they are the proper height.

- (b) To level, use an accurate straight edge and a level, a long rubber hose with a gauge glass at each end and filled with water, or a leveling instrument if one is available. The remaining elevation stakes should be driven, and leveled.

A two-course foundation should then be poured as follows:

- (a) String lines  $1\frac{1}{2}$  inch from the top of the leveling stakes.
- (b) Pour the rough base even with the lines and tamp it well. The mix should be of the proper proportions depending on the size of the stone used. For medium size stone a 1:2:4 mix should be satisfactory. Never pour more base than can be topped and finished the same day.
- (c) Place screeds so that their top surfaces are flush with the tops of the leveling stakes.
- (d) Pour the top course and drag it off flush with the tops of the screeds; then remove the screeds, drive the leveling stakes down slightly, and fill in with concrete.
- (e) Trowel the surface well.
- (f) When the foundation has properly set, the corkboard should be laid and water-proofed with pitch.

## ASSEMBLING THE TANK

- (a) Clean all sheets at the laps thoroughly. Do not use paint or paper in the seams.
- (b) The tank bottom sheets should be placed on bucks 22 inches high above the insulated floor. Convenient bucks can be made by nailing two pieces of 2 by 4 together to form an inverted "T." The cross piece should be about 18 inches long and the vertical piece 20 inches long. These bucks should be set on paper so that the cross piece will not adhere to and mar the asphalt coating on the cork. Sufficient bucks must be used to support the tank evenly and without buckling. The tank should be assembled directly above its exact position and maintained in this position by means of blocks placed in between the tank and the surrounding walls or columns.
- (c) Lap weld the two bottom sheets together as shown on drawing S435204Y. When welding sheets together bear in mind that the heat of the weld causes the sheets to creep together unless held firmly in place. Therefore, tack weld the sheets underneath the tank together with welds 2" long, on 18" centers, beginning in the center of the tank and working toward the ends. After completing these welds start the continuous weld in the seam on the inside of the tank. This weld must be started from the center of the tank and finished to each end of the seam.
- (d) The vertical side and end sheets should be placed on edge on the bottom sheet projecting beyond the outside of the vertical sheets. The side sheets should extend the full length of the bottom, and the end sheets must fit in between the side sheets. The side and end sheets should then be continuously welded to the bottom sheets on the inside. When the vertical sheets are placed, they should be slanted outward slightly so as to compensate for the drawing effect of the weld.

Next, plumb the end sheets and wedge the side sheets out from the end sheets  $\frac{1}{8}$  inch for each foot height of the seam. Then begin on the inside of the bottom and weld up, relieving the wedge as the weld progresses to allow the sheets to draw together.

- (e) Before testing the bottom of the tank, weld all support post angles, support angles, and the angle iron (11) to the tank bottom. To test the tank bottom for leaks, run in about 6 inches of water and allow it to stand over night. Then drain the water out, and while the tank bottom is still wet, dry all welded seams with a blow torch and use care not to heat the metal. A leak will be shown by a damp spot appearing on the weld which has been dried with the torch. This

water had soaked into the defective weld while the water was standing in the tank, and seeped out after the outside had been dried.

- (f) Before lowering the tank into position, see that all end and side blocking is secure. Block up the tank with columns of wood timbers about 2" thick that are easily removable one piece at a time, remove the 2 by 4 bucks, and walk the tank gradually and evenly down to its permanent base.

## ASSEMBLING AND WELDING VERTICAL TRUNK COILS

After the tank is in place on its foundation, the coils and suction trap should be placed in the tank. Stand the coil up in the vertical position on 12 inch high blocking, align it with the suction trap, and make the connecting welds. Test them with air pressure at 150 pounds to check these welds.

Then lower the assembled coil sufficiently so that, when the tank is full of water, the top of the header will be completely submerged. Temporarily brace the tank against the surrounding walls and columns to prevent bulging and fill it with water to test the tank side and end seams, and to finally test the submerged coil while subjected to 150 pounds air pressure.

The coil must not be moved into final position until after the submergence test. When this test shows that coils and tank sides are satisfactory, drain the water out, dry the tank, and paint the tank bottom and side that form part of the trunk. Then move the coils into final position.

The trunk sheet should then be continuously welded to the backing angle at the bottom, the tank side at the top, and to the tank end at the agitator. Then paint all parts of the tank not already painted.

All remaining tie rods, can supports, wood framework, etc., should then be welded, bolted, or nailed in place as indicated by the drawings for the particular installation. When all work inside the tank is completed, the tank should be thoroughly cleaned before brine is mixed.

## PLACING CANS AND MIXING BRINE

Clean the tank thoroughly of all rubbish resulting from installing the wood framework and tank insulation.

Turn fresh water into the tank until the level is about 20 inches from the top of the tank. The cans should then be brought in, lowered into position, and filled with just enough water to hold them down. As more cans are added it will be necessary to add more water to the cans already in place in order to hold them down. After all cans are in place and filled enough to hold them down, the can covers should be placed in position.

Before adding any salt to the water in the tank, drain out, if necessary, sufficient water to bring the level down to about 11 inches from the top of the tank. When mixing brine, it is well to arrange a strainer basket to extend below the water level. This strainer will then, as the salt is dumped in and dissolved, catch pieces of lint and other foreign matter which might be dumped in with the salt. During the entire time salt is being added it is necessary to operate the agitator in order to dissolve the salt. When fine salt is used, do not dump it in the tank faster than it will dissolve. Otherwise it may pack and harden between cans to such an extent that the cans cannot be removed.

The final brine level should be equal to or slightly above the finished ice level at the point in the tank where the brine is the lowest with reference to the finished ice level.

After the brine is mixed and is at the proper level, the granulated cork should be poured and packed in between the tank and walls. Care should be used to prevent the cork falling into the cans and brine, or on the covers. It is well to protect the covers with a tarpaulin while the cork is being poured.

A day or two before the first freeze is to start, all cans should be pulled, the water dumped out, and the cans thoroughly cleaned and refilled with clean water so as to make the first tank of ice useable.

After putting the plant into initial operation, the compressor should continue running until all of the water in the cans is frozen solid. Then pull the cans and refill with water at the rate of 3 per hour, during day and night.

## SODIUM CHLORIDE (COMMON SALT) BRINE

Salt brine is used in these tanks, and its strength should be such that it will not freeze on the evaporator surface.

While a brine strength of 80 salometer is usually sufficient for the operating conditions encountered in most ice plants, the tendency of most operators is to make the brine a little stronger, thinking to play safe. This tendency, when carried too far, can defeat its purpose, and cause ice formation with very strong salt brine. The following table illustrates the point:

<i>Specific Gravity</i>	<i>Salometer</i>	<i>Freezing Point °F.</i>
1.150	75.2	+ 1.8
1.158	79.1	— 0.8
1.166	79.1	— 3.0
1.175	86.8	— 6.0
1.183	90.2	+ 3.8
1.191	94.0	+ 16.1

Note that the freezing point falls as the density increases to 86.8 salometer, and that with further increase in density, the freezing point rises rapidly.

## BRINE TREATMENT

The only brine treatment required is that the operator suspend a 50-lb. sack of slaked lime in the brine and allow it to dissolve, when the plant is first placed in operation.

## CONDENSING UNIT

### (1) INSTALLATION

The compressor and motor are leveled and aligned with the base at the factory. Therefore, it is merely necessary to place the unit, lower it to within about one inch from the top of its foundation, level the base by means of wooden wedges, grout it as outlined below, and tighten the foundation bolts.

To apply V-belts, slide the motor forward sufficiently to place them in the grooves without stretching. When all belts are in their grooves, they should be tightened sufficiently to prevent slipping; if they are too tight, wear will be excessive. These belts require no lubrication or dressing.

#### A. Grouting

Build a frame around the top of the foundation that will hold at least 2 inches of grout. Mix two parts of clean sharp sand with one part of Portland cement, and add enough water to make a mixture that will flow freely. Wet the foundation top thoroughly and pour the grout in from all sides, and work it well with a limber strip of metal to insure solid grout over the entire base and in all foundation bolt holes. Continue pouring and stirring until the grout rises to the top of the dam. If any low spots form after the dam is full, these should be promptly filled.

When the grout has hardened sufficiently to be self-supporting, remove the dam and trowel the grout down even with the bottom of the machine base and give it

a slight pitch to the outside so that any water or oil will drain off the foundation. To make a nice smooth job, trowel a thin layer of cement on the foundation.

After the grout is reasonably hard, which usually requires four or five days, draw down the foundation bolt nuts uniformly all around until reasonably tight. Use care not to spring the base castings, as this will throw the shaft out of line and cause heating of the bearings, and may even cause the crankshaft to break at some later date.

### PROPERTIES OF BRINE

#### PROPERTIES OF SOLUTIONS OF PURE SODIUM CHLORIDE IN WATER

% Pure NaCl by Weight	Salometer Degrees 59° F.	Specific Gravity 59° F.	Specific Heat 59° F.	Weight of 1 Gallon	Pounds per Gallon		Weight of 1 cu. ft.	Pounds per Cubic Foot		Freezing Point Deg. Fahr.
					NaCl	Water		NaCl	Water	
0	0	1.000	1.000	8.35	0	8.35	62.4	0	62.4	32.0
5	18.2	1.035	0.938	8.65	0.432	8.22	64.6	3.230	61.37	27.0
6	22.5	1.043	0.927	8.71	0.523	8.19	65.1	3.906	61.19	25.5
7	26.0	1.050	0.917	8.76	0.613	8.15	65.5	4.585	60.91	24.0
8	29.6	1.057	0.907	8.82	0.706	8.11	66.0	5.280	60.72	23.2
9	33.5	1.065	0.897	8.89	0.800	8.09	66.5	5.985	60.51	21.8
10	37.2	1.072	0.888	8.95	0.895	8.05	66.9	6.690	60.21	20.4
11	41.1	1.080	0.879	9.02	0.992	8.03	67.4	7.414	59.99	18.5
12	44.8	1.087	0.870	9.08	1.090	7.99	67.8	8.136	59.66	17.2
13	48.7	1.095	0.862	9.14	1.188	7.95	68.3	8.879	59.42	15.5
14	52.6	1.103	0.854	9.22	1.291	7.93	68.8	9.632	59.17	13.9
15	56.8	1.111	0.847	9.28	1.392	7.89	69.3	10.395	58.90	12.0
16	60.0	1.118	0.840	9.33	1.493	7.84	69.8	11.168	58.63	10.2
17	64.0	1.126	0.833	9.40	1.598	7.80	70.3	11.951	58.35	8.2
18	68.0	1.134	0.826	9.47	1.705	7.76	70.8	12.744	58.06	6.1
19	71.7	1.142	0.819	9.54	1.813	7.73	71.3	13.547	57.75	4.0
20	75.2	1.150	0.813	9.60	1.920	7.68	71.8	14.360	57.44	+1.8
21	79.1	1.158	0.807	9.67	2.031	7.64	72.3	15.183	57.12	-0.8
22	82.8	1.166	0.802	9.74	2.143	7.60	72.8	16.016	56.78	-3.0
23	86.8	1.175	0.796	9.81	2.256	7.55	73.3	16.854	56.45	-6.0 (eutectic)
24	90.2	1.183	0.791	9.88	2.371	7.51	73.8	17.712	56.09	+3.8
25	94.0	1.191	0.786	9.95	2.488	7.46	74.3	18.575	55.72	+16.0
		1.20								+32.0

TABLE 3

## B. Cleaning and Inspection of Compressor

Before starting the compressor for the first time, the crankcase hand hole cover should be removed and the inside of the crankcase thoroughly cleaned. Use clean rags for this purpose, as the lint and threads from waste are apt to remain inside the crankcase and cause trouble by clogging the oil ways.

The compressor top heads should be removed and the suction valves, discharge valves, and cylinder walls cleaned with Ammonia Compressor Oil. Be sure all valves work freely before they are replaced. During the cleaning process, protect the cylinders and other parts from sand and grit by keeping them covered with clean paper or cloth.

After the crankcase has been cleaned, it should be filled with new Ammonia Compressor Oil before the crankcase cover is replaced. The proper oil level is shown by the oil level mark on the side of the crankcase.

## (2) MAINTENANCE

### A. Packing

The packing for this compressor consists of a set of compound rings and a soft packing oil seal ring. Each compound ring is made up of a metallic ring overlaid with a filler ring.

The packing should be installed as follows:

- (a) Clean and oil the stuffing box and the shaft.
- (b) See that the steel bottom ring is in place as illustrated.
- (c) Place a metallic ring around the shaft with the flange as shown in the illustration. Roll the ring down smooth with a wood block, and if necessary cut off to provide  $\frac{1}{16}$ -inch gap between ends.

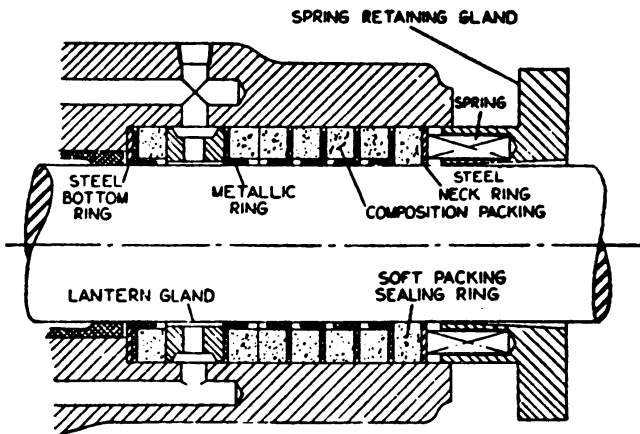


FIG. 27

- (d) Place the filler ring over the metal ring and stagger the joints.
- (e) Start the assembled ring into the stuffing box by hand. Then in order to be sure that the assembled ring will be seated in place without becoming disarranged in the slightest degree and that the metallic ring will not be damaged by bending out of position, use four short pieces of wood of equal length fastened around the shaft as shown in Fig. 28. The gland should be used to push the ring in with the sticks to seat it firmly in place. The same sticks may be used for several sizes of compressors.

- (f) Assemble and insert the second ring with the flange as shown in the illustration. Be sure that the correct number of rings are inserted before the lantern gland as shown in the illustration.
- (g) Insert the cast iron lantern gland, or internal spring retainer and spring, furnished with the compressor, and make sure it comes in line with the oil inlet hole.

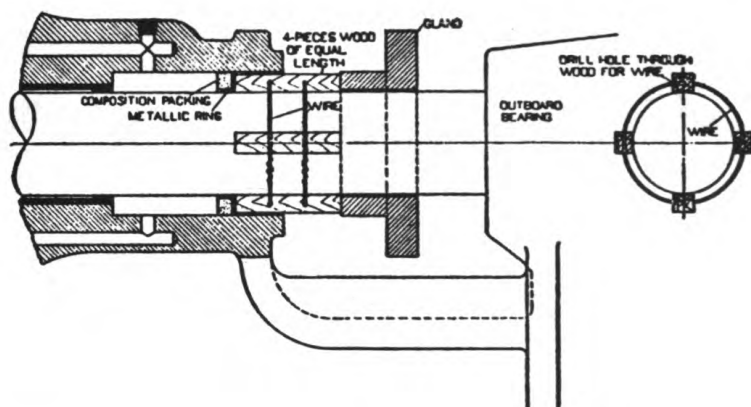


FIG. 28

- (h) For the external spring loaded type stuffing box, assemble and insert the additional rings as shown in the illustration, staggering all joints. Seat the rings firmly in place with a packing collar, or with stocks of wood as described in (e). Fill the box to within  $\frac{1}{4}$  inch or  $\frac{1}{2}$  inch of the end, using as the last ring the oil seal ring. Install the metallic neck ring and the solid or spring retaining gland, and draw the gland nuts finger tight only.

The gas pressure in the crankcase will force plenty of oil into the packing. The oil will seal the stuffing box against gas leakage, and provides lubrication for the packing.

Give the packing a chance to wear in. If it blows excessively at the start, remove the oil seal ring and take up a little more on the compound rings; go slowly in taking up until you are sure there is plenty of oil working out from the crankcase into the packing.

After running for several days, oil leakage should not be more than a drop or two per hour.

## B. Pumping Out the Condenser

If it is necessary to remove the ammonia from the condenser it should be done in the following manner:

- (a) Shut off the water supply to the condenser and drain the condenser by removing the drain plugs in the condenser heads.
- (b) With the compressor shut down and valves (A) and (B) open, drain the condenser into the evaporator coils by opening all valves between the condenser and evaporator.
- (c) When the condenser and evaporator pressures equalize, close valve (B), start the compressor, and pump a slight vacuum on the crankcase. Then stop the compressor and immediately close valve (C). The condenser and crankcase pressures, when equalized, should then be below the evaporator pressure.
- (d) The condenser should then contain only gas. This gas should be blown out

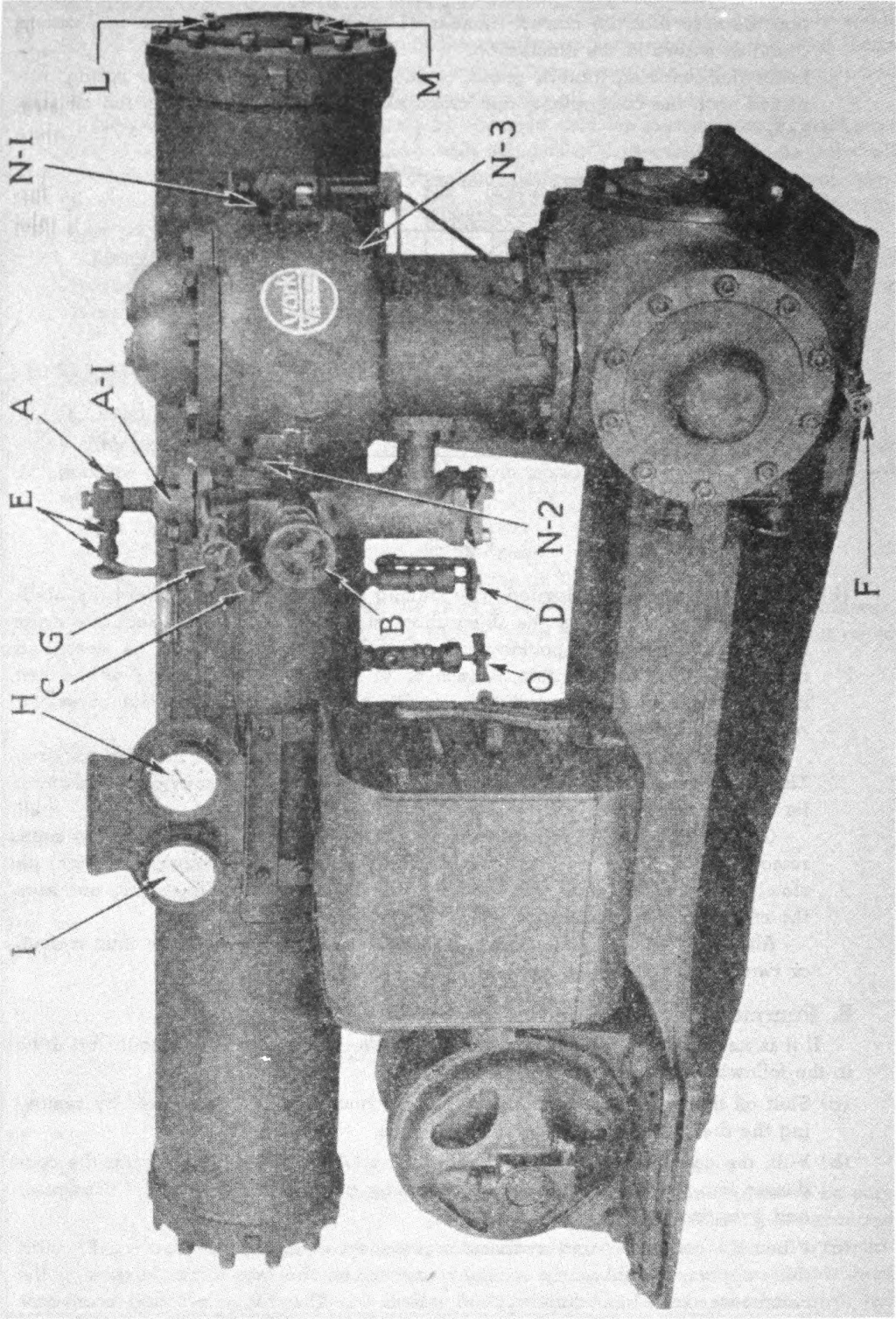


FIG. 29

through the oil drain valve into a pail of water. It may be necessary to use several pails of water in order to avoid excessive ammonia fumes.

- (e) After the condenser has been opened up and repairs made, the air in the condenser must be removed. This can be done without running the compressor. Simply close purge valve (E), discharge valve (A), and the oil drain valve. Then open valve (O) and permit ammonia to flow from the evaporator into the condenser. Remove plug from (E).
- (f) Open purge valve (E) slightly and blow the air out into a pail of water. When the air has been removed, the system can be put into operation. However, extra precaution is necessary in starting up the compressor, due to the excess ammonia which is stored in the evaporator. Start the compressor as outlined for Starting Compressor, but open suction valve (B) very slowly, and be ready to close it for a few seconds if the compressor starts to knock.

## AMMONIA FLOAT REGULATOR

### Installation and Maintenance

Before a float regulator is installed it should be opened up and examined. The mechanism should be lubricated with Ammonia Compressor Oil, and must work freely. After the float regulator has been assembled, work the float ball up and down several times to make sure it clears the back of the float chamber throughout its entire travel. To do this, extend a wire hook through the liquid inlet (18) and catch the float rod. CAUTION: Do not tighten the float ball on the float rod by turning the ball. Use a small pipe wrench or pliers on the spud which is soldered to the float ball, so as not to break the solder and cause a leak.

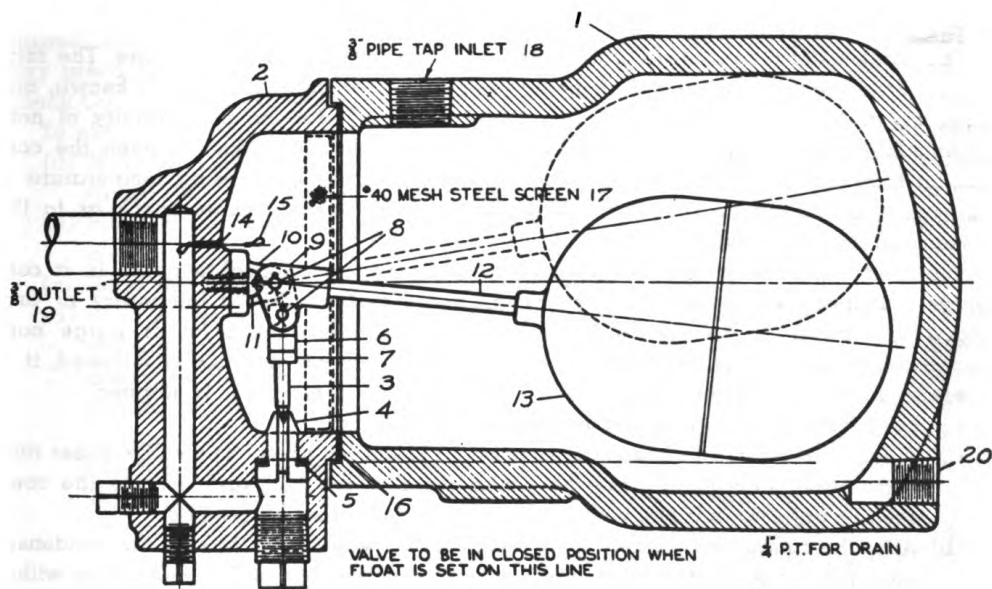


FIG. 30

To open up a high pressure float regulator after the plant has been charged, first close valve "U," Fig. 3, and wait a few minutes; then close valve (S). The ammonia that remains in the float body can then be blown out through the oil drain connection (20) into a pail of water.

If the float regulator fails to drain the condenser, a condition that will be shown by a fall in suction pressure:

- (a) Open up the float body; see that the leak hole and valve ports are free from dirt and scale.
- (b) Clean the strainer (17).
- (c) Lubricate all moving parts and make sure the mechanism works freely.
- (d) Determine by measurement whether or not the float ball (13) clears the back of the float chamber. With the float rod (12) horizontal, measure from the back of the float ball to the face of the float head flange. Then measure from the face of the float body flange to the back inside wall of the float body. The clearance should be ample to insure free operation of the float.
- (e) See that float ball has not collapsed, and that it does not contain liquid. If the float ball contains liquid, be sure all liquid is out before attempting to solder the leak.

If the float regulator allows gas to pass into the evaporator, a condition that will be indicated by a rise in temperature of the liquid line out of the float regulator, and a decrease in plant capacity:

- (a) Open the float body; examine the valve (3) and the valve seat (4). If these parts are corroded or the clearance is excessive, the worn parts should be renewed.
- (b) Lubricate all moving parts and see that the mechanism works freely.
- (c) Determine by measurement whether or not the float ball clears the back of the float chamber.

## CONDENSER MAINTENANCE

Non-condensable gases in a condenser cause excessive condensing pressure and should never be allowed to remain in a system. The operator should keep a close check on this condition at all times.

The condensing temperature of ammonia varies directly with the pressure. The relation between the pressure and condensing temperature of pure ammonia is known, and is shown on ammonia gauges and in ammonia tables. Also, as the quantity of non-condensable gases in a condensing system increases, the difference between the condensing temperature of the contaminated ammonia and the condensing temperature of pure ammonia increases; it is this difference that provides a definite check as to the presence of non-condensable gases.

The most satisfactory time to check for or purge non-condensable gases in a condenser is immediately before starting the ammonia system after a temporary or prolonged shut down. If the system is shut down over night, check for or purge non-condensable gases in the morning before starting. When this practice is followed, it is necessary to close the liquid outlet valve (O) before the compressor is stopped.

To check for non-condensable gases, proceed as follows:

- (a) When it is desired to check the ammonia system for non-condensable gases during normal operation, close the liquid outlet valve (O) and operate the compressor until the normal suction pressure is decreased 10 pounds.
- (b) After the compressor has stopped, continue the water flow through the condenser until the temperature of the liquid from the condenser and the pressure within the condenser do not further decrease.
- (c) If the pressure gauge at the compressor discharge is used to determine the pressure within the condenser, be sure compressor discharge stop valve is open.
- (d) Read the temperature of the liquid ammonia leaving the condenser. This is the actual condensing temperature.
- (e) Read the condensing temperature which corresponds to the condensing pressure. This temperature is shown in red on the ammonia pressure gauge, and is the condensing temperature of pure ammonia.

- (f) Then subtract the actual condensing temperature (temperature of liquid leaving the condenser) from the condensing temperature of pure ammonia (temperature shown in red on the ammonia gauge). If the difference between these temperatures is more than 3 degrees, it is necessary to purge.

## TO PURGE THE CONDENSER

- (a) Check the condenser for non-condensable gases as explained above.
- (b) Allow the water to flow through the condenser for about fifteen minutes, or until there is no further decrease of the liquid temperature from the condenser and the condensing pressure is constant.
- (c) To absorb the ammonia fumes which may escape, provide a hose or pipe connection from the condenser purge valve into a bucket of water. Air in passing through the water will merely bubble, whereas the ammonia will be absorbed by the water with a definite "cracking" sound. It will probably be necessary to renew the water several times during the purging operation.
- (d) Slowly release the non-condensable gases from the condenser by means of the purge valve provided. CAUTION: The proportion of ammonia gas that will mix with the non-condensable gases and escape while the condenser is being purged, will depend upon the rate of purging and the concentration of the non-condensable gases in the condenser. To keep the ammonia loss to a minimum while purging, purge slowly and continually check the condenser for the presence of non-condensable gases as explained above.

## TO CHECK CONDENSER PERFORMANCE

The over-all check for condenser performance may be used to indicate the condition of the condensing surface after, AND ONLY AFTER, the condenser has been properly purged. The most satisfactory time to check for condenser performance, and the necessary precautions required for an accurate check are the same as explained under "To Check Condenser for Non-condensable Gases."

To obtain an over-all check of condenser performance, proceed as follows:

- (a) Make preliminary preparations to the system as explained in (a), (b), and (c) under "To Check for Non-condensable Gases."
- (b) Read the condensing temperature which corresponds with the pressure in the condenser.
- (c) Read the temperature of the water leaving the condenser.
- (d) Then subtract the temperature of the water leaving the condenser from the condensing temperature obtained in (b). The temperature of the water leaving the condenser will be several degrees below the condensing temperature of pure ammonia. This temperature difference is affected by the amount of condensing surface per ton of refrigeration, by the condition of the condensing surface, and by the presence of non-condensable gases. Therefore, the condenser performance should be checked when the load conditions are known and the condenser is known to be clean and free from non-condensable gases, and the results used as a measure of good performance. However, for this check to be of value, it should always be made under conditions similar to those prevailing when the condenser was known to be in good condition.

When this temperature difference increases 4 or 5 degrees with the condenser free from non-condensable gases, it is necessary to clean the condenser tubes.

## TO CLEAN CONDENSER TUBES

To clean the condenser tubes it is necessary to first drain the condenser and then remove the water connections and pass heads. When the pass heads are removed be careful not to damage the rubber gaskets between the condenser and the pass head.

In order to thoroughly clean the condenser tubes, a good sturdy tube cleaner should be used. When the tubes become caked with hard scale, it takes more than a brush to clean them. The Yorkco tube cleaner is satisfactory to remove scale accumulation of normal hardness; for extreme hard scale, the automatic tube cleaner is recommended. When tubes are very dirty, it may be necessary to run a stiff wire brush through them first and then finish up with the tube cleaner. By connecting a water hose to the pipe to which the tube cleaner is fastened, and by drilling a few small holes in the pipe at the tube cleaner end, water can be admitted to the tubes during the process of cleaning. The water prevents the tube cleaner from becoming clogged, and also insures cleaner tubes.

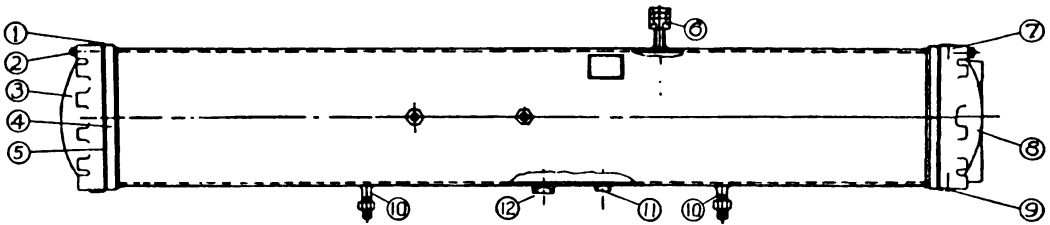


FIG. 30A

## Parts

- 1 Head Joint
- 2 Head Stud
- 3 Back Head
- 4 Tube Head
- 5 Head Gasket
- 6 Gas Inlet Tee

## Parts

- 7 Vent
- 8 Front Head
- 9 Drain
- 10 Stud
- 11 Oil Drain
- 12 Liquid Outlet

**PART III**  
**PART SECTION**

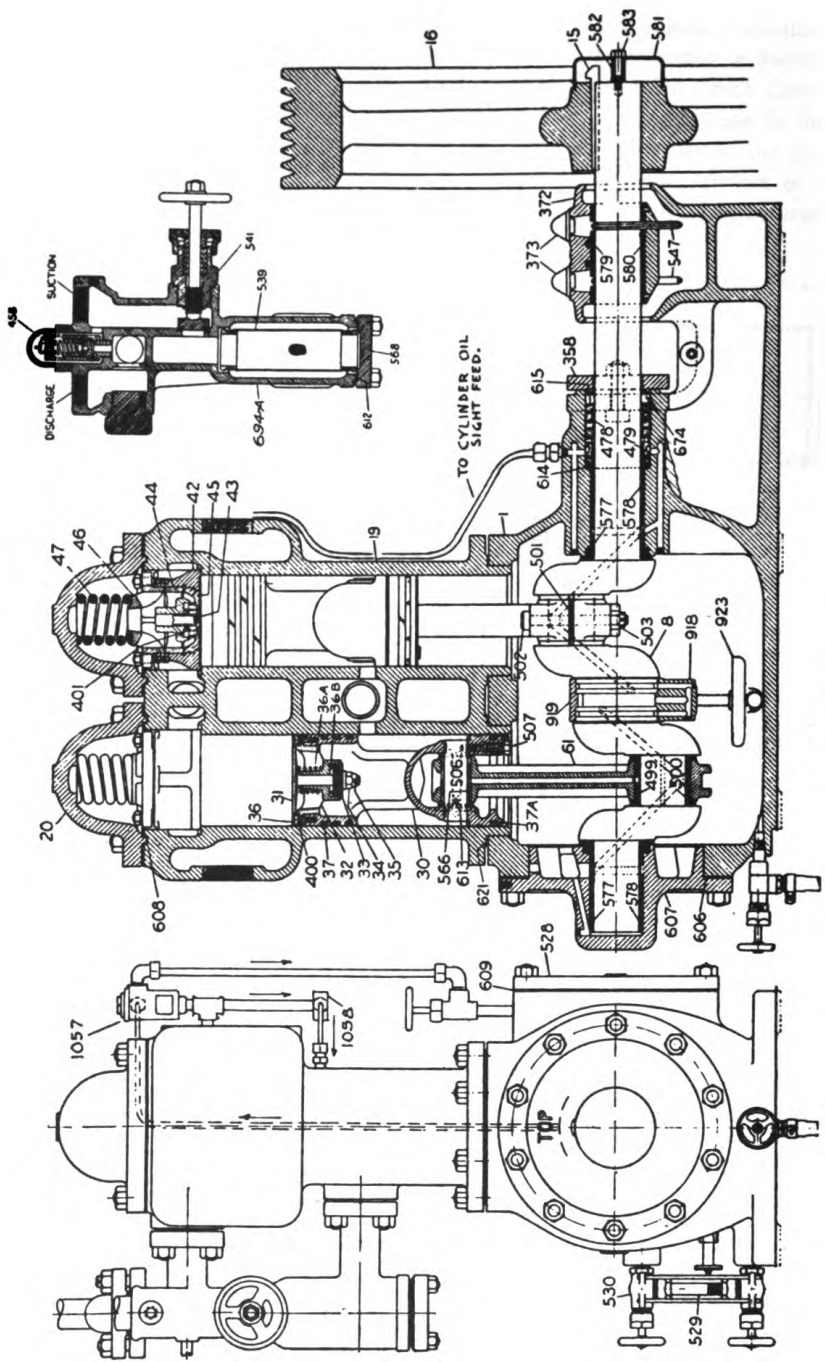


FIG. 31

## LIST OF PARTS

### 5" x 5" COMPRESSOR

Serial Numbers 169906-11 to 169914-23

Serial Numbers 187685 to 187774

Ref. No.	Name of Piece	Number Required	York Drwg. No.	Description
1	Compressor Base .....	1	143470	
8	Crankshaft .....	1	143010	
15	Flywheel Key .....	1	161704	
16	Flywheel .....	1	122233	
19	Compressor Cylinder .....	1	122077	
20	Compressor Top Heads .....	2	95372	
30	Pistons .....	2	136830	
31	Suction Valve .....	2	163331	
32	Suction Valve Cage .....	2	149952	
33	Suction Valve Piston .....	2	149951	
34	Suction Valve Nut .....	2	149952	1/2"/20 S.A.E. Castle Nut
35	Suction Valve Locking Key ....	2	149952	1/8" x 1 1/4" Wire
36	Suction Valve Cage Screws ...	8	65755	5/16" x 7/8" Rd. Hd. Screws
36A	Suction Valve Springs .....	2	149952	No. 591
36B	Suction Valve Piston Springs ..	2	149952	No. 595
37	Piston Snap Rings .....	6	136830	
37A	Piston Rings, Beveled .....	2	136830	
42	Safety Heads .....	2	129790	
43	Discharge Valves .....	2	115143	
44	Discharge Valve Cage .....	2	115143	
45	Discharge Valve Seat .....	2	115143	
46	Discharge Valve Cage Cap ...	2	130337	
47	Safety, Head Springs .....	2	129790	No. 402
61	Connecting Rods .....	2	143651	
358	Stuffing Box Gland .....	1	149054	
372	Outboard Bearing Cap .....	1	143500	
373	Bearing Cap Oil Hole Cover ...	1	143500	
400	Suction Valve Cage Scr. Wash.	8	65755	
401	Discharge Valve Spring .....	2	115143	No. 574
458	Relief Valve .....	1	154309	
478	Stuffing Box Rings .....	Box	149054	See Instructions
479	Stuffing Box Lantern Gland ....	1	149054	See Instructions
499	Connecting Rod Bearings .....	2	162958	Upper Half
500	Connecting Rod Bearings .....	2	162958	Lower Half
501	Connecting Rod Liners .....	4	148730	
502	Connecting Rod Bolts .....	4	162544	5/8" x 5 1/4"
503	Connecting Rod Bolt Nuts .....	4	162544	5/8" S.A.E. Castle
506	Piston Wrist Pin .....	2	162564	
507	Wrist Pin Cap Screw and Lock- washer .....	2	136830	Spec. 3/8" x 2 1/4" Dog. Pt.
528	Hand Hole Cover .....	1	143653	
529	Oil Level Sight Glass .....	1	148397	
530	Sight Glass Valves .....	2	148397	
539	Suction Strainer Screen .....	1	114595	

**LIST OF PARTS (Cont'd)****5" x 5" COMPRESSOR****Serial Numbers 169906-11 to 169914-23****Serial Numbers 187685 to 187774**

Ref. No.	Name of Piece	Number Required	York Drwg. No.	Description
541	Suction Stop Valve .....	1	112687	
547	Outboard Bearing Ring .....	2	143500	Bronze
566	Wrist Pin Bushings .....	2	162958	
568	Strainer Body Cover .....	1	103034	
577	Main Bearing .....	2	143594	Upper Half
578	Main Bearing .....	2	143594	Lower Half
579	Outboard Bearing .....	1	143509	Upper Half
580	Outboard Bearing .....	1	143509	Lower Half
581	Flywheel Hub Shield .....	1	99012	
582	Hub Shield Ferrule .....	1	99012	$\frac{3}{8}$ " x $1\frac{3}{16}$ " Pipe
583	Hub Shield Screw .....	1	99012	$\frac{3}{8}$ " x 2" BH Cap Screw
606	End Bearing Head Gasket .....	1	143470	Fibre
607	End Bearing Head .....	1	143653	
608	Compressor Top Head Gasket ..	2	122077	Lead
609	Hand Hole Cover Gasket .....	1	143470	Fibre
612	Strainer Cover Gasket .....	1	103034	Fibre
613	Wrist Pin Locating Pin .....	2	162738	
614	Stuffing Box Neck Ring .....	2	149054	Bottom Ring
621	Compressor Cylinder Gasket ...	2	143470	
674	Stuffing Box Springs .....	8	149054	No. 512
694A	Valve Manifold .....	1	140809	
918	Oil Pump Body .....	1	143056	
919	Oil Pump Body Cap .....	1	143056	
920	Oil Pump Follower .....	1	143056	
921	Oil Pump Body Stop .....	1	143056	
922	Oil Pump Follower Spring .....	1	143056	
923	Oil Pump Strainer .....	1	135049	
1057	Oil Sight Feed .....	1	171725	
1058	Oil Distributor .....	1	165577	

## LIST OF PARTS

## COMPRESSOR SPARE PARTS (See Fig. 31)

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
19	94-1	Compressor Cylinder with Studs .....	_____	146.56	280
20	94-2	Compressor Top Head .....	_____	15.20	24
—	94-3	Stud Bolts, $\frac{5}{8}$ "-11 NC. x $2\frac{3}{4}$ " .....	_____	.14	.25
—	94-3A	Nuts, $\frac{5}{8}$ " Hex. ....	_____		
608	94-4	Gasket, Compressor Top Head .....	_____	.93	.10
607	94-5	Bearing Head .....	_____	27.94	65
577	94-6	Bearing, D.C., Upper Half .....	_____	12.32	1.6
578	94-6	Bearing, D.C., Lower Half .....	_____	Incl.	1.6
—	94-7	Stud Bolts, $\frac{5}{8}$ "-11 NC x $2\frac{1}{4}$ " .....	_____	.14	.25
—	94-7A	Nuts, $\frac{5}{8}$ " Hex. ....	_____	Incl.	
606	94-8	Gasket, Bearing Head .....	_____	1.27	.10
528	94-9	Hand Hole Cover .....	_____	11.41	31
609	94-10	Gasket, Hand Hole Cover .....	_____	1.00	.15
—	94-11	Stud Bolts, $\frac{5}{8}$ "-11 NC x $2\frac{1}{2}$ " .....	_____	.14	.25
—	94-11A	Nuts, $\frac{5}{8}$ " Hex. ....	_____	Incl.	
577-78	94-12	Main Bearing .....	_____	12.32	3.2
478	94-13	Stuffing Box Packing (Box) .....	_____	6.46	1
479	94-14	Stuffing Box Lantern Gland .....	_____	6.95	3
674	94-15	Stuffing Box Spring .....	_____	.13	.12
358	94-16	Stuffing Box Gland .....	_____	7.53	9.6
—	94-17	Gland Tee Bolts, $\frac{5}{8}$ "-11 NC x $3\frac{1}{2}$ " .....	_____	.50	.5
—	94-17A	Hex. Nuts, $\frac{5}{8}$ " for Tee Bolts .....	_____	Incl.	
373	94-18	Bearing Cap Oil Hole Cover .....	_____	.80	.6
579	94-19	Outboard Bearing, Upper Half .....	_____	12.32	.6
580	94-19	Outboard Bearing, Lower Half .....	_____	Incl.	.8
547	94-20	Outboard Bearing Oil Ring .....	_____	.80	.5
16	94-21	Flywheel .....	_____	132.55	732
15	94-22	Flywheel Key .....	_____	1.21	.25
581	94-23	Flywheel Hub Shield .....	_____	2.09	1
583	94-23	Flywheel Hub Shield Screw .....	_____	Incl.	.25
47	94-24	Safety Head Spring .....	_____	1.40	1
44	94-25	Discharge Valve Cage .....	_____	6.52	2.4
46	94-25	Discharge Valve Cage Cap .....	_____	Incl.	3.6
401	94-26	Discharge Valve Spring .....	_____	.26	.5
43	94-27	Discharge Valve .....	_____	4.92	.75
45	94-28	Discharge Valve Seat .....	_____	4.48	3.8
—	94-29	Discharge Valve Stud Nut, $\frac{3}{8}$ "-16 NC. ....	_____	.01	.12
—	94-30	Discharge Valve Stud Lockwasher .....	_____	.003	.05
42	94-31	Safety Head .....	_____	16.20	9.6
31	94-32	Suction Valve .....	_____	7.92	2.6
32	94-33	Suction Valve Cage .....	_____	7.07	4.8
36A	94-34	Suction Valve Spring .....	_____	.55	.05
33	94-35	Suction Valve Piston .....	_____	.55	.36
34	94-36	Suction Valve Nut .....	_____	.03	.05
—	94-37	Wire, $\frac{1}{8}$ " x $1\frac{1}{4}$ " lg. ....	_____	.02	.01
30	94-38	Piston, Bare .....	_____	26.65	26.4
37	94-39	Piston Ring, Plain .....	_____	1.05	.25
37A	94-40	Piston Ring, Beveled .....	_____	.52	.25
506	94-41	Wrist Pin .....	_____	3.98	1.9
507	94-42-43	Wrist Pin Cap Screw and Lockwasher ..	_____	.69	.5
61	94-44	Connecting Rod .....	_____	35.75	15
499	94-45	Connecting Rod Bearing, Upper Half ....	_____	3.55	1
500	94-46	Connecting Rod Bearing, Lower Half ....	_____	3.55	1
566	94-47	Wrist Pin Bushing, Bronze .....	_____	7.54	4.2
502	94-48	Connecting Rod Bolts .....	_____	2.16	1.3
503	94-49	Connecting Rod Castellated Nut .....	_____	.10	.25
—	94-50	Wire, $\frac{1}{8}$ " x $1\frac{7}{8}$ " .....	_____	.02	.01
501	94-51	Shims, $\frac{7}{32}$ " x $2\frac{23}{32}$ " .....	_____	.44	.01
—	94-52	Oil Line Tubing, $\frac{3}{8}$ " O.D. x $10\frac{1}{4}$ " .....	_____	.25	.15

## LIST OF PARTS

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
613	94-53	Wrist Pin Dowel Pin .....	_____	.05	.01
8	94-54	Crankshaft .....	_____	143.00	100
—	94-55	Pipe Plug, $\frac{1}{8}$ " Slotted Head .....	_____	.17	.04
—	94-56	Tap Bolt, Nut and L'kwasher, $\frac{1}{2}$ "-13 x $1\frac{1}{4}$ " .....	_____	.07	.25
694A	94-57	Valve Manifold Body .....	_____	34.65	37
541	94-58	Valve Bonnet .....	_____	2.90	4.4
541	94-59	Valve Packing Nut .....	_____	1.20	1.5
541	94-60	Valve Hand Wheel .....	_____	.90	1.2
541	94-61	Valve Stem .....	_____	3.55	5.63
—	94-62	Hex. Nut, $\frac{1}{2}$ " .....	_____	.01	.10
541	94-63	Valve Stem Packing Gland .....	_____	.60	.25
541	94-64	Valve Stem Washer .....	_____	.15	.05
541	94-65	Valve Bonnet Gasket .....	_____	.05	.01
541	94-66	Valve Stem Packing Rings .....	_____	.34	.65
—	94-67	Tap Bolt, $\frac{1}{2}$ "-13" x $1\frac{1}{8}$ " (16) .....	_____	1.22	.25
568	94-68	Strainer Body Cover .....	_____	1.46	3.6
539	94-69	Strainer Screen Assembly .....	_____	4.67	5.5
		(a) Wire Cloth			
		(b) No. 16 Wire, 16" lg.			
		(c) Screw Rings			
458	94-70	Relief Valve Cap .....	_____	1.60	2.4
458	94-71	Relief Valve Cartridge .....	_____	11.60	2
458	94-72	Relief Valve Gasket .....	_____	.05	.01
458	94-73	Relief Valve Stud and Nut, $\frac{3}{8}$ "-11" x $2\frac{1}{2}$ " .....	_____	.05	.50
—	94-74	Strainer Cover Stud and Nut, $\frac{1}{2}$ "-13" x $2\frac{3}{8}$ " .....	_____	.05	.50
612	94-75	Strainer Cover Gasket .....	_____	.05	.01

## CONDENSING UNIT SPARE PARTS (See Fig. 29)

—	94-76	Unit Base Plate .....	100424	64.75	370
—	94-76A	Dowel Taper Pin, $\frac{3}{8}$ " x $2\frac{1}{2}$ " .....	P400722	Incl.	.5
—	94-76B	Hex. Nut, $\frac{3}{8}$ " 11 NC .....	_____	Incl.	.25
—	94-77	Motor Plate .....	95399	23.65	86
—	94-78	Adjusting Screw, $\frac{3}{8}$ "-11" x $5\frac{1}{4}$ " .....	95399	.47	.66
—	94-79	Tap Bolts, $\frac{3}{8}$ "-11" x 2" (4) .....	_____	.20	.50
—	94-80	Washers, $\frac{3}{8}$ " Flat .....	_____	.08	.25
—	94-81	Control Board .....	141593	4.05	5
H	94-82	Ammonia L.P. Gauge, 150 lb., Ashcroft ...	_____	9.65	3
I	94-83	Ammonia H.P. Gauge, 300 lb., Ashcroft ...	_____	9.65	3
—	94-84	Screws and Nuts, No. 10-24" x $\frac{3}{8}$ " .....	_____	.01	.25
—	94-85	Screws and Nuts, $\frac{3}{8}$ "-16" x $1\frac{1}{4}$ " .....	_____	.12	.25

## TOOLS AND WRENCHES

—	94-86	Funnel Ring, 5" .....	62538	5.77	5
—	94-87	Oil Gauge Plate .....	174369	.25	.25
—	94-88	Screw, Parker Kalon No. 4 x $\frac{1}{4}$ " .....	_____	.01	.05
—	94-89	Wrench, $\frac{3}{8}$ " Drop Forged 15° .....	_____	.42	2
—	94-90	Wrench, $\frac{1}{2}$ " Drop Forged 15° .....	_____	.55	2
—	94-91	Wrench, $\frac{5}{8}$ " Drop Forged 15° .....	_____	.89	2
—	94-92	Wrench, $\frac{3}{4}$ " Drop Forged 15° .....	_____	1.18	2
—	94-93	Wrench, $\frac{7}{8}$ " Socket .....	39208	1.10	2
—	94-94	Wrench, $\frac{3}{8}$ " Socket .....	67512	.64	.7
—	94-95	Wrench, $\frac{5}{8}$ " Socket .....	39208	.92	1.8
—	94-96	Draw Bolt, $\frac{1}{4}$ " x $3\frac{3}{4}$ " .....	96243	.26	.08
—	94-97	Eye Bolt, $\frac{3}{8}$ " x 10" .....	47503	.26	.54
—	94-98	Packing Hook, 7" .....	_____	.56	.05
—	94-99	Screw Driver, T-Handle .....	80230	1.98	.5
—	94-100	Tube Cleaner, Condenser .....	_____	.72	.25
—	94-101	Wedge, Leveling, 3" x 6" Oak .....	_____	.10	—
—	94-102	Plate, Leveling, 3" x 6" Oak .....	_____	.10	—

## LIST OF PARTS

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
<b>AMMONIA PIPING SPARE PARTS (See Fig. 3)</b>					
49	94-103	Relief Valve, 1/2" .....	Fig. 14	29.00	10
A-3	94-104	Dual Relief Valve Fitting .....	Fig. 20	30.45	10
A-3	94-105	Flange, 3/4" Oval Male, B & G .....	_____	.775	2
52	94-106	Elbow, 1/2" Screwed .....	_____	.40	1
A-3	94-107	Pipe Plug, 1/2" Square Head .....	_____	.35	.5
14	94-108	Flange Pair, 1 1/2" Square, B & G .....	_____	2.25	3.5
53	94-109	Flange Pair, 1/2" Oval, B & G .....	_____	1.26	2
13	94-110	Elbow Screwed and Square Flange, 1 1/2" .....	_____	4.15	9
12	94-111	Elbow, Screwed, 1 1/2" .....	_____	1.19	4
—	94-112	Elbow, Screwed, 3/4" .....	_____	.49	1.5
—	94-113	Steel Pipe, 1 1/2" F.W. 20'-0" lg. ....	_____	2.70	40
W	94-114	Valve, 1/4" Angle .....	_____	4.10	2
—	94-115	Adapter, 1/4" Female .....	_____	1.27	.05
—	94-116	Tubing, 1/4" O.D. Steel .....	_____	1.30	8.5
—	94-117	Adapter Nut, 1/4" .....	_____	.18	.02
—	94-118	Tubing, 1/4" O.D. Steel .....	_____	1.60	8.5
—	94-119	H.P. Cut-out Connection Assembly .....	_____	3.25	.65
—	94-120	Tee, 1/4" Screwed .....	_____	.39	.50
—	94-121	Nipple, 1/4" x 2 1/2" E.H. ....	_____	.06	.05
3	94-122	Valve, 1" Oval Flange Angle .....	_____	9.29	10
4-5	94-123	Flanges, Pair Oval, B & G .....	_____	1.54	4 1/2
48	94-124	Relief Valve, 1/2" .....	Fig. 14	29.00	10
A-2	94-125	Dual Relief Valve Fitting .....	Fig. 20	30.45	10
A-2	94-126	Flange, 3/4" x 1/2" Oval Male, B & G .....	Fig. 20	.70	2
—	94-127	Nipple, 1 1/4" x 2 1/2" .....	_____	.10	.90
27	94-128	Elbow, 1/2" Screwed .....	_____	.40	1
—	94-129	Nipple, 1/2" x 3" .....	_____	.07	.3
—	94-130	Plug, 1/2" Steel .....	_____	.26	.3
4-5	94-131	Flange Pair, 1" Oval, B & G .....	_____	1.54	4.5
2	94-132	Elbows, 1" Street .....	_____	.59	1
—	94-133	Steel Tubing, 1/4" O.D. x 10' .....	_____	1.30	8.5
—	94-134	Adapter, 1/4" Male and Nut .....	_____	.90	.50
—	94-135	Valve, 1 1/4" Water Regulating .....	Fig. 13	44.20	15
—	94-136	Valve, 1/2" Screwed Angle .....	_____	6.13	10
—	94-137	Nipple, 1" x 2" .....	_____	.07	.4
—	94-138	Nipple, 1" x 4" .....	_____	.09	.7
—	94-139	Nipple, 1/2" x 6" .....	_____	.15	1.2
8	94-140	Bell, 4" Alarm .....	Fig. 21	11.92	5
4	94-141	Transformer, 25VA .....	Fig. 21	5.97	10
6	94-142	L.P. Mercoid Cut-out .....	Fig. 21	22.75	5
7	94-143	H.P. Mercoid Cut-out .....	Fig. 21	22.75	5
—	94-144	Bolts and Nuts, 1/4" x 3/4" .....	_____	.02	.05
<b>WATER PIPING SPARE PARTS (See Figs. 15-16)</b>					
17	94-145	Strainer, 2" Galvanized Water .....	_____	24.75	15
1	94-146	Valve, 2" Brass Gate .....	_____	6.80	10
8	94-147	Valve, 3/4" Brass Gate .....	_____	2.05	5
3	94-148	Valve, 1/2" Brass Globe .....	_____	1.87	4
11	94-149	Tee, 2" Galvanized .....	_____	.92	1
14	94-150	Tee, 2" x 3/4" x 2" Galvanized .....	_____	.92	1
40	94-151	Tee, 2" x 2" x 1 1/4" Galvanized .....	_____	.92	1
13	94-152	Tee, 2" x 1/2" x 2" Galvanized .....	_____	.92	1
10	94-153	Tee, 1" x 3/4" x 3/4" Galvanized .....	_____	.33	.6
15	94-154	Tee, 2" x 1" x 2" Galvanized .....	_____	.92	1
41	94-155	Tee, 3/4" Galvanized .....	_____	.24	.5
6	94-156	Elbow, 2" Galvanized .....	_____	.55	.7
7	94-157	Elbow, 1" Galvanized .....	_____	.21	.3
8	94-158	Elbow, 3/4" Galvanized .....	_____	.16	.3
9	94-159	Elbow, 1" x 3/4" Galvanized .....	_____	.21	.3

## LIST OF PARTS

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
18	94-160	Elbow, 1½" Galvanized		.39	.5
38	94-161	Bushing, 2" x 1¼"		.23	.25
34	94-162	Bushing, 2" x ¾" C.I.		.23	.20
—	94-163	Bushing, 1¼" x ¾" C.I.		.12	.15
4	94-164	Union, 2" Galvanized		.90	1
5	94-165	Union, ¾" Galvanized		.25	.50
—	94-167	Nipple, 2" x 6" Galvanized		.26	1.5
—	94-168	Nipple, 1½" x 6" Galvanized		.20	1.25
—	94-169	Nipple, 1¼" x 6" Galvanized		.17	1
—	94-170	Nipple, 1¼" x 4" Galvanized		.11	1
—	94-171	Nipple, 1" x 6" Galvanized		.13	1
—	94-172	Nipple, ¾" x 6" Galvanized		.10	.75
—	94-173	Nipple, ¾" x 4" Galvanized		.07	.50
—	94-174	Nipple, ½" x 6" Galvanized		.075	.40
—	94-175				
19	94-176	Pipe, 2" F.W. Galvanized, 20'-0" lg.		5.00	50
22	94-177	Pipe, 1½" F.W. Galvanized, 20'-0" lg.		3.20	40
—	94-178	Pipe, 1¼" F.W. Galvanized, 20'-0" lg.		2.70	30
21	94-179	Pipe, 1" F.W. Galvanized, 20'-0" lg.		2.20	25
20	94-180	Pipe, ¾" F.W. Galvanized, 20'-0" lg.		1.40	20

## CONDENSER SPARE PARTS (Fig. 30A)

—	94-181	Condenser-Receiver	195789	242.40	1100
—	94-182	Pipe, 14" O.D. Black, 6'-10¼" lg.	195515	15.00	270
4	94-183	Condenser Tube Head	195025	30.00	66
5	94-184	Condenser Head Gasket	195637	1.70	.5
—	94-185	Condenser Bracket	112831	6.75	29
—	94-186	Condenser Bracket Bolt, ¾" x 1¾"		.05	.25
—	94-187	Condenser Tube, 1¼" O.D., 7'-0¼" lg.		1.08	8
8	94-188	Condenser Front Head	195092	14.35	74
3	94-189	Condenser Back Head	195093	12.65	70
2	94-190	Condenser Head Stud and Nut	195676	.12	.38
—	94-191	Valve, ¾" Angle Purge	8639FH	4.10	2
—	94-192	Valve, ¾" Globe	2172F	5.49	3
—	94-193	Coupling, ¾"	2104	.18	.30

## AMMONIA PIPING SPARE PARTS (See Fig. 3)

—	94-194	Steel Pipe, 20'-¾" E.H.		1.40	15
—	94-195	Steel Pipe, 20'-½" E.H.		1.50	22
53-54	94-196	Ova' Flange Pair, B & G	1657-8F	1.15	4
52	94-197	Elbow, ½" Screwed	8439-F	.40	1
—	94-198	Elbow, ¾" Screwed	8438F	.35	1
—	94-199	Nipple, 1½" x 6" E.H.		.25	1.8
—	94-200	Nipple, 1½" x 4" E.H.		.20	1.2
—	94-201	Nipple, 1½" x 6" E.H.		.12	.5
—	94-202	Nipple, ½" x 4" E.H.		.09	.3
—	94-203	Nipple, ¾" x 4" E.H.		.08	.25
—	94-204	Nipple, ¾" x 6" E.H.		.11	.36
"O"	94-205	Valve, ¾" Screwed Angle	7071-F	5.49	3
"D"	94-206	Valve, ½" Screwed Angle	7073-FC	8.00	5
—	94-207	Hangers, 1½" Insulated Pipe	121566	.50	5
—	94-208	Flat Iron, 18', 1¼" x ¼"		2.16	22
—	94-209	Machine Bolts and Nuts, ¾" x 1¼"		.035	.07
—	94-210	Glycerine, Quart		.80	5
—	94-211	Litharge, 6 lbs.		1.38	6
—	94-212	Oil, Cutting		.75	5
—	94-213	Bolt, ½" x 1¼"		.03	.10
—	94-214	Hex. Nut, ½"		.02	.05
—	94-215	Bolt and Nut, ¾" x 1"		.035	.12

## LIST OF PARTS

## COMPRESSOR OIL GAUGE SPARE PARTS (See Fig. 31)

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Lbs.
530	94-216	Sight Glass Valve, Top .....	5225FA	7.15	8
530	94-217	Sight Glass Valve, Bottom .....	7799FA	7.15	8
529	94-218	Sight Glass .....	148397	.47	.5
—	94-219	Sight Glass Guard Rods .....	148397	.15	.25
—	94-220	Sight Glass Gaskets, No. 8 Acme .....	148397	.10	.05

## OIL PIPING SPARE PARTS (See Fig. 31)

1057	94-221	Oil Sight Feed Distributor .....	171725	8.28	5
—	94-222	Adapters, 1/4" Female, Angle .....	7077F	1.45	.32
—	94-223	Adapters, 1/4" Male, Angle .....	7212F	1.70	.26
—	94-224	Adapters, 1/4" Male, Straight .....	7079F	.90	.14
—	94-225	Adapters, 1/8" Male, Straight .....	7080F	.83	.14
—	94-226	Nipple, 1/4" x 3" E.H. ....	_____	.072	.07
—	94-227	Nipple, 1/4" E.H. Close .....	_____	.054	.05
—	94-228	Steel Tubing, 1/4" O.D., 10' lg. ....	_____	1.30	8

## MOTOR DRIVE SPARE PARTS (See Fig. 29)

—	94-229	Pulley, Motor, 6 <sup>3</sup> / <sub>16</sub> " Diameter .....	B-11541MD	33.55	69
—	94-230	Pulley, Motor, 7 <sup>7</sup> / <sub>16</sub> " Diameter .....	P300339XA	35.00	72
—	94-231	V-Belt, Dayton B-180 .....	_____	4.25	5
—	94-232	Bolts, Starter-Stand 1/2" x 1 1/4" .....	_____	.04	.10
—	94-233	Lockwasher, 1/2" .....	_____	.01	.02
—	94-234	Tap Bolt, 5/8" x 1 3/4" .....	_____	.08	.12
—	94-235	Conduit, Flexible, 36" lg. ....	_____	.60	8
—	94-236	Connector, 1 1/4" Box, 90° .....	AC9114	.60	3
—	94-237	Connector, 1 1/4" Box, Straight .....	SC114	.25	2
—	94-238	Wire, No. 4 RC, 12' lg. ....	_____	.72	5
—	94-239	Bushing, 1 1/4" CI. ....	_____	.06	.25
—	94-240	Locknut, 1 1/4" Conduit .....	_____	.03	.20
—	94-241	Bushing, 1 1/4" Conduit .....	_____	.06	.25

## AGITATOR SPARE PARTS (See Fig. 8)

4	94-242	Housing .....	435864	50.50	80
3	94-243	Bearing .....	435864	4.05	2
8	94-244	Packing Nut .....	5839G	1.35	.35
7	94-245	Impeller, 8" Bronze .....	7655F	18.00	2.5
—	94-246	Impeller Key, 3/4" x 5 <sup>5</sup> / <sub>16</sub> " x 3/16" .....	435864	.70	.10
10	94-247	Set Screw, 1/2" x 5/8" .....	_____	.05	.05
5	94-248	Shaft .....	435864	13.50	7.6
—	94-249	Set Screw, 1/2" x 1/2" .....	_____	.05	.05
9	94-250	Coupling .....	435864	8.10	5.5
—	94-251	Coupling Key, 1/4" x 1/4" x 5" .....	_____	.50	.09
—	94-252	Elbow, 1/4" Screwed .....	_____	.27	.50
—	94-253	Nipple, 1/4" x 2 1/4" .....	_____	.04	.20
—	94-254	Nipple, 1/4" x 1 3/4" .....	_____	.04	.15
—	94-255	Pipe Plug, 1/4" Standard .....	_____	.15	.10
—	94-256	Cap Screws, 3/8" x 1 1/4" .....	_____	.07	.07
—	94-257	Set Screws, 3/8" x 1 1/8" .....	_____	.07	.07
—	94-258	Cap Screws, Square Head, 3/8" x 1 1/4" .....	_____	.08	.07
2	94-259	Grease Cup, Essex No. 0, Fig. 75 .....	_____	1.75	.25
11	94-260	Agitator Funnel .....	128097	107.50	88
—	94-261	Bolt and Nut, 5/8" x 1 5/8" .....	_____	.06	.26

## EVAPORATOR COIL SPARE PARTS (See Fig. 7)

6	94-262	Suction Header, 3" x 7'-0" .....	S437049	30.00	52.5
11	94-263	Liquid Header, 3" x 9'-0" .....	S437050	32.00	67.5
8	94-264	Pipe Coil .....	163049	2.15	15

## CAN TRUCK AND HOIST SPARE PARTS (See Fig. 10)

14	94-265	Can Dog .....	J. F. Burns	5.00	—
13	94-266	Lifting Chain .....	J. F. Burns	4.32	—
11	94-267	Ratchet Wheel .....	J. F. Burns	.90	—
10	94-268	Pawl and Bracket .....	J. F. Burns	1.00	—

## LIST OF PARTS

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
—	94-269	Cotter Pins .....	J. F. Burns	.03	—
8	94-270	12" Wheels .....	J. F. Burns	5.50	—
16	94-271	Front Bracket .....	J. F. Burns	2.65	—
6	94-272	Rear Bracket .....	J. F. Burns	3.75	—
1	94-273	Bearings, Bronze Shaft .....	J. F. Burns	1.40	—
2	94-274	Crank Handle Bracket .....	J. F. Burns	.65	—
12	94-275	Chain Drum .....	J. F. Burns	4.40	—
3	94-276	Half Iron Handle .....	J. F. Burns	.40	—
4	94-277	Maple Standard .....	J. F. Burns	3.30	—
15	94-278	Wood Roller .....	J. F. Burns	2.00	—
5	94-279	Wood Handle .....	J. F. Burns	.55	—
—	94-280	Can Filler, Complete .....	J. F. Burns	18.75	—
<b>AMMONIA FLOAT VALVE SPARE PARTS (See Fig. 12)</b>					
"V"	94-281	No. 2H-HP Float Valve, Fig. 3 .....	144353	39.50	25
"X"	94-282	Manifold By-Pass, Fig. 3 .....	131754	38.50	10
1	94-283	Float Body .....	144353	9.50	15
2	94-284	Float Head .....	143303	7.60	8
16	94-285	Float Head Gasket .....	—	.10	.12
—	94-286	Tap Bolts, $\frac{3}{8}$ " x $2\frac{1}{4}$ " .....	—	.09	.20
10	94-287	Toggle Support .....	7497F	.85	.10
13	94-288	Float Ball .....	—	2.50	.50
12	94-289	Float Rod, $\frac{3}{16}$ " x $2\frac{3}{4}$ " .....	—	.37	.15
17	94-290	Internal Screen .....	143303	.70	.05
3	94-291	Needle Valve Stem .....	143303	3.75	.20
4	94-292	Needle Valve Seat .....	—	4.75	.25
6	94-293	Needle Valve Socket Link .....	—	.80	.10
7	94-294	Socket Link Lock Nut .....	—	.30	.05
8	94-295	Toggle Pin .....	—	.25	.05
8	94-296	Needle Valve Pin .....	—	.25	.05
11	94-297	Toggle Support Screw .....	—	.05	.05
9	94-298	Toggle .....	—	1.20	.20
—	94-299	Plug, $\frac{1}{8}$ " Pipe .....	—	.10	.06
—	94-300	Plug, $\frac{1}{4}$ " Pipe .....	—	.12	.08
—	94-301	Cotter Pin .....	—	.02	.02
5	94-302	Valve Seat Gasket .....	—	.10	.01
<b>CAN DUMP SPARE PARTS (See Fig. 9)</b>					
—	94-303	Can Dump .....	F435098	203.15	250
7	94-304	Rocker Support .....	1248G	12.80	52
10	94-305	Rockers .....	1634-35G	6.60	18
—	94-306	Nipple, $\frac{3}{4}$ " x 3" .....	435098	.05	.3
—	94-307	Hose Clamp .....	—	.10	.07
—	94-308	Angle Iron, 2" x 2" x $\frac{1}{4}$ "-37" .....	149168	2.70	10
—	94-309	Pipe Ferrule, $\frac{3}{4}$ " x 9" .....	435098	.05	.84
11	94-310	Valve, $\frac{3}{4}$ " Quick Opening .....	—	10.20	15
—	94-311	Flat Iron Brace, $1\frac{1}{2}$ " x $\frac{1}{4}$ " x $10\frac{1}{4}$ " .....	435098	.45	1.28
2	94-312	Flat Iron Supports, 2" x $\frac{3}{8}$ " x 21" .....	435098	2.00	5
3	94-313	Angle Iron, 2" x 2" x $\frac{1}{4}$ ", 10 $\frac{3}{8}$ " .....	—	.58	3
—	94-314	Angle Iron, 2" x 2" x $\frac{1}{4}$ ", 6" .....	—	.60	1.6
14	94-315	Stud Bolt, $\frac{5}{8}$ " x $13\frac{1}{4}$ " .....	—	.05	1.2
—	94-316	Bolt, $\frac{1}{2}$ " x $3\frac{1}{2}$ " with Nut .....	—	.02	.07
9	94-317	Carriage Bolt, $\frac{3}{8}$ " x $2\frac{1}{2}$ " .....	—	.02	.07
8	94-318	Carriage Bolt, $\frac{3}{8}$ " x 6" .....	—	.04	.2
4	94-319	Elbow, $\frac{3}{4}$ " Screwed .....	—	.09	.40
—	94-320	Nipple, $\frac{3}{4}$ " x $2\frac{1}{4}$ " .....	435098	.05	.2
6	94-321	Hose, 3 Ply, 1" x 21" lg. ....	—	.87	1
13	94-322	Oak Piece, $1\frac{7}{8}$ " x 6" x 20" .....	435098	3.75	1.8
12	94-323	Oak Piece, $1\frac{7}{8}$ " x 5" x 6" .....	435098	.57	.5
1	94-324	Steel Sheet, $19\frac{1}{2}$ " x $35\frac{1}{2}$ " x $\frac{1}{8}$ " .....	47575	5.40	25
—	94-325	Steel Sheet, 4" x 8" x $\frac{1}{8}$ " .....	149168	.45	1.7

## LIST OF PARTS

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
—	94-326	Angle Iron, 2½" x 2½" x ¼" x 8" lg. ....	—	1.20	2.7
—	94-327	Flat Steel, 20½" x 1¼" x ¼" .....	435098	.65	1.9
—	49-328	Oak Plank, 8" x 34½", 2" .....	149168	7.55	6
—	94-329	Machine Bolt, ¾" x 1½" .....	—	.05	.07
—	94-330	Machine Bolt, ¾" x 2" .....	—	.06	.08
—	94-331	Lockwashers .....	—	.01	.01
—	94-332	Stove Bolts, ¼" x 2" FH. ....	—	.02	.03
—	94-333	Rivets, ¾" x ¾" Cone Head .....	—	.01	.02
—	94-334	Rivets, ¾" x ¾" Flat Head .....	—	.01	.02
—	94-335	Pipe Clip, ⅛" x ½" x 3½" F.S. ....	—	1.00	.07
—	94-336	Stove Bolt, ⅜" x ¼" R.H. ....	—	.005	.02
—	94-337	End Piece .....	1636G	1.60	17
—	94-338	Flat Steel, 1½" x ⅛" x 10" .....	149168	.04	.6
—	94-339	Rivets, ¾" x 1" Round Head .....	—	.01	.02
—	94-340	Counterweight, 6" x 7¾" x 1½" St. ....	149168	3.8	2.3
5	94-341	Sprinkler Pipe, ½" x 27" .....	149168	2.05	1.8
5	94-342	Sprinkler Pipe, ½" x 14" .....	149168	2.05	1
—	94-343	Nipple, ¾" x 3¾" .....	—	.08	.4
—	94-344	Nipple, ¾" x 3" .....	—	.05	.28
—	94-345	Nipple, ¾" x 4" .....	—	.08	.4
—	94-346	Tee, ¾" Screwed .....	—	.15	.20
—	94-347	Elbow, ¾" Screwed .....	—	.11	.20
—	94-348	Elbow, ½" Screwed .....	—	.07	.20
—	94-349	Elbow, ¾" x ½" Screwed .....	—	.09	.20
—	94-350	Pipe Cap, ½" .....	—	.05	.15
<b>ICE TANK SPARE PARTS (See Fig. 6)</b>					
11	94-351	Can Holding Down Spring .....	636708	.30	.50
12	94-352	Can Holding Down Spring .....	636709	.27	.50
<b>20 H.P. STARTER SPARE PARTS (See Fig. 25)</b>					
28	94-353	Thermal Relay Latch Arm .....	478776	.42	—
27	94-354	Latch Spring .....	485926	.16	—
29	94-355	Latch Push Rod .....	478778	.42	—
12	94-356	Movable Contact .....	256922	.35	—
17	94-357	Movable Contact Spring .....	279415	.48	—
—	94-358	208 Volt, 3 Phase, 60 Cycle Starter .....	S577174	133.00	—
1A	94-359	400 Volt, 3 Phase, 50 Cycle Hold. Coil ....	S261658	3.71	—
30A	94-360	400 Volt, 3 Phase, 50 Cycle O.L. Relay Htrs. ....	S760593	1.35	—
<b>20 H.P. MOTOR SPARE PARTS (See Fig. 24)</b>					
7	94-361	Bearing .....	688535	3.75	—
8	94-362	Oil Ring .....	49621	.825	—
5-6	94-363	Inner Dust Cap .....	779501	1.90	—
3	94-364	Washer, Inner Felt .....	779503	.50	—
4	94-365	Outer Dust Cap .....	443731A	1.90	—
—	94-366	Motor, 400 Volt, 3 Phase, 50 Cycle .....	4G2968	172.00	—
<b>1½ H.P. MOTOR AND STARTER SPARE PARTS (See Fig. 26)</b>					
—	94-367	Thermal Relay Latch .....	—	.053	—
—	94-368	Latch Spring .....	—	.19	—
—	94-369	Movable Contact .....	—	.20	—
—	94-370	Movable Contact Spring .....	—	.27	—
—	94-371	208 Volt, 3 Phase, 60 Cycle Starter .....	—	8.45	—
—	94-372	400 Volt, 3 Phase, 50 Cycle O.L. Heaters..	—	1.35	—
—	94-373	Motor, 1½" H.P., 200 Volt, 3 Phase, 60 Cycle	26548	68.00	—
16	94-374	Ball Bearings, Set .....	—	7.50	—
2	94-375	Dust Caps, Inner and Outer .....	—	1.50	—
—	94-376	Bearing Removal Tool .....	—	15.00	—

## LIST OF PARTS

### COMPRESSOR OIL PUMP SPARE PARTS (See Fig. 31)

Fig. Ref.	Item No.	Part Description	Symbol or Dwg.	Price Each	Weight Each Lbs.
—	94-377	Oil Pump Assembly .....	143056	10.50	11
918	94-378	Oil Pump Body .....	14305	4.58	6.6
919	94-379	Oil Pump Body Cap .....	143056	3.70	3.6
920	94-380	Oil Pump Plunger .....	143056	1.06	.28
921	94-381	Oil Pump Stop .....	143056	.17	.65
—	94-382	Tap Bolts, $\frac{1}{2}$ " x $1\frac{3}{4}$ " .....	_____	.04	.05
—	94-383	Tap Bolts, $\frac{3}{8}$ " x 1" .....	_____	.02	.02
—	94-384	Lockwashers, $\frac{1}{2}$ " .....	_____	.003	.01
—	94-385	Lockwashers, $\frac{3}{8}$ " .....	_____	.003	.01
922	94-386	Spring .....	143056	.21	.03
—	94-387	Plug, $\frac{1}{8}$ " Pipe .....	_____	.17	.07
323	94-388	Oil Strainer Body .....	135049	2.90	1.2
—	94-389	Oil Strainer Ring .....	135049	.32	.04
—	94-390	Oil Strainer Cover Ring .....	135049	.47	.04
—	94-391	Oil Strainer Screen .....	135049	.42	.05
—	94-392	Nipple, $\frac{1}{4}$ " x $2\frac{3}{8}$ " .....	_____	.10	.10
—	94-393	Cap Screws, $\frac{3}{16}$ " x $\frac{3}{8}$ " .....	_____	.03	.05
—	94-394	Manual .....	S1-494	2.50	—
—	94-395	Tube Expander (Ajax), $1\frac{1}{4}$ " O.D., 13 BWG Tubes .....	_____	—	—

### FIRST ECHELON SPARES PARTS AND TOOLS

Part Description	Quantity	Price Each	Unit Weight Lbs.	Total Weight Lbs.
B-180 V-Belts, Compressor .....	9	4.25	5	45
Oil Filling Hose .....	1	1.00	2	2
Oil Hose Nipple and Clamp .....	1	Incl.	5	.5
Compressor Oil, 5 Gal. Can .....	2	3.81	40	80
Oil Can .....	1	1.02	.05	.5
Oil, Cutting .....	1 qt.	.50	2	2
387-T Wrench, Socket, $\frac{5}{8}$ " x $\frac{3}{4}$ " .....	1	.92	2	2
390-T Wrench, Socket, $\frac{7}{8}$ " x 1" .....	1	1.10	2	2
80230 Screw Driver, T Handle .....	1	1.98	2	2
662-T Socket Wrench, $\frac{3}{8}$ " .....	1	.64	1	1
Glycerine .....	1 qt.	.84	2	2
Litharge .....	1 lb.	.20	1	1
Ammonia, 150 lb. Drum .....	2	50.50	250	500
Manual .....	1	2.50	—	—
Sulphur Sticks .....	25	—	—	—
Slaked Lime, 50 lb. Sack .....	1	—	—	—
Hydrometer .....	1	—	—	—
Nessler's Solution, Bottle .....	1-2 oz.	—	—	—

